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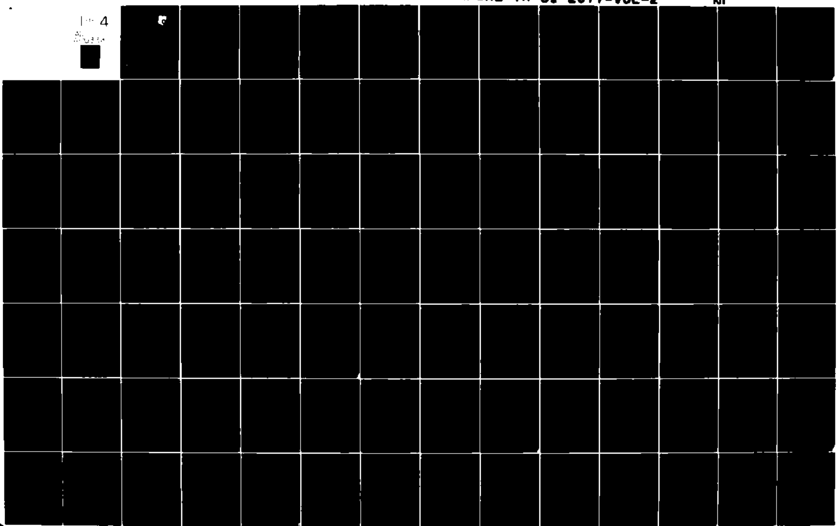

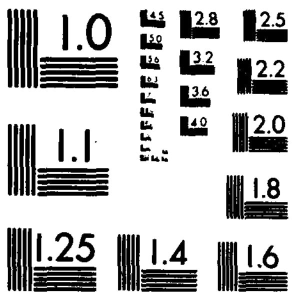

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Volume II

LEVEL III

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EXPERIMENTAL INVESTIGATION OF TURBINE ENDWALL HEAT TRANSFER

Volume II. Linear and Annular Cascade Summary Data Sets

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Detroit Diesel Allison
Division of General Motors Corporation
P. O. Box 894
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August 1981

FINAL REPORT for period 1 August 1977 - 31 August 1981

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This technical report has been reviewed and is approved for publication.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Two turbine cascades were tested at simulated engine conditions to provide a data base of endwall heat transfer data. This data base is intended to be sufficiently complete to provide verification data for refined computational models developed to predict first-stage stator endwall heat transfer in advanced turbine engines.

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20. ABSTRACT (Cont)

A linear, two-dimensional cascade provided the bulk of the data. This cascade provided data to separate the effects of exit Mach number, exit Reynolds number, inlet boundary layer thickness, gas-to-wall temperature ratio, inlet pressure gradients, and inlet temperature gradients. In addition, adiabatic wall temperature and inlet turbulence intensity data are available for the linear cascade runs. A computerized data base was generated. This data base, with its associated software management system, provides the user with relatively easy access to the vast amount of data generated.

A full annular, three-dimensional cascade was used to acquire data for identifying the radial pressure gradient effects. Tests in the annular cascade were run over a wide range of exit Mach and Reynolds numbers and gas-to-wall temperature ratios, all at levels typical of advanced engines.

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VOLUME II

LIST OF ILLUSTRATIONS

LIST OF TABLES

1.0 INTRODUCTION

This volume contains summary plots of the results of both the linear and annular cascade test programs. Detailed local tabulated data will be available on magnetic tape, as described in Volume III.

The details of the linear and annular cascade test plans were presented in Volume I. It is intended that the test plans outlined in Volume I be utilized with the summary plots in Volume II to aid the reader in selecting specific groups of runs for analysis. The data presented in this volume should be adequate to identify data trends for the analyst. It should also provide sufficient detail to the designer to estimate endwall cooling levels and to locate areas of high heat transfer rates. However, detailed information on local endwall heating rates for both the analyst and designer will require utilization of the overall data base, described in Volume III.

2.0 LINEAR CASCADE

The dat[illegible]n this sectio[illegible] will include summaries of all Phase I and Phase II results [illegible] the linear [illegible]scade. Run conditions are summarized and general de[illegible]s of the types of data plots that are available are given. The [illegible]y of specific plots for each run is tabulated and the individual [illegible]ach run are then presented.

[illegible]NDITIONS

[illegible]lan for the [illegible] cascade investigation was organized to span the [illegible] factors expe[illegible] to influence vane endwall heat transfer and asso[illegible]sage aerodynam[illegible], except for radial pressure gradient effects [illegible] the annular cascade task. Details of the various series of tests were given in Section 4 of Volume I and will not be repeated here. A summary of the inlet and exit flow conditions for the linear cascade runs is given in [illegible]

TABLE 1. LINEAR CASCADE RUN CONDITIONS

	Inlet conditions					Exit conditions		
Run No.	Gas total temperature (°F)	Total pressure (psia)	Static pressure (psia)	Mach number	Reynolds number x 10^{-6}	Mach number	Reynolds number x 10^{-6}	Expansion ratio
57	197	21.4	20.9	0.19	0.43	0.71	1.34	1.40
61	[illegible]	37.5	36.5	0.20	0.81	1.10	2.76	2.13
[illegible]	[illegible]	[illegible]	15.3	0.14	0.23	0.30	0.46	1.06
[illegible]	[illegible]	[illegible]	21.0	0.18	0.19	0.70	0.59	1.37
[illegible]	[illegible]	[illegible]	21.1	0.18	0.23	0.71	0.74	1.39
[illegible]	[illegible]	[illegible]	15.3	0.09	0.07	0.27	0.20	1.05
[illegible]	[illegible]	[illegible]	50.3	0.20	0.50	1.10	1.68	2.11
[illegible]	[illegible]	[illegible]	15.4	0.10	0.06	0.28	0.17	1.05
[illegible]	[illegible]	[illegible]	54.4	0.19	0.43	1.09	1.52	2.07
[illegible]	[illegible]	[illegible]	21.2	0.19	0.17	0.69	0.52	1.36
[illegible]	[illegible]	[illegible]	20.9	0.20	0.46	0.71	1.31	1.40
[illegible]	[illegible]	[illegible]	36.8	0.23	0.94	1.10	2.83	2.13
[illegible]	[illegible]	[illegible]	15.8	0.11	0.18	0.31	0.48	1.07
[illegible]	[illegible]	[illegible]	53.3	0.23	0.60	1.12	1.82	2.11
[illegible]	[illegible]	[illegible]	20.8	0.20	0.20	0.68	0.59	1.36
[illegible]	[illegible]	[illegible]	21.7	0.20	0.27	0.72	0.78	1.40
[illegible]	[illegible]	[illegible]	21.8	0.21	0.19	0.72	0.54	1.40
[illegible]	[illegible]	[illegible]	15.4	0.10	0.08	0.28	0.21	1.05
[illegible]	[illegible]	[illegible]	42.3	0.19	0.40	0.70	1.20	1.37
118	[illegible]	[illegible]	33.9	0.18	0.31	0.69	0.96	1.36
[illegible]	[illegible]	[illegible]	58.4	0.19	0.57	0.71	1.74	1.39
[illegible]	[illegible]	[illegible]	31.3	0.18	0.30	0.69	0.92	1.36
[illegible]	[illegible]	[illegible]	37.0	0.12	0.21	0.30	0.50	1.06
[illegible]	[illegible]	[illegible]	64.0	0.10	0.32	0.30	0.96	1.06
[illegible]	[illegible]	[illegible]	33.9	0.18	0.31	0.69	0.95	1.36
[illegible]	[illegible]	[illegible]	33.3	0.18	0.30	0.69	0.94	1.37
[illegible]	[illegible]	[illegible]	31.7	0.21	0.34	0.69	0.91	1.36
[illegible]	[illegible]	[illegible]	34.4	0.09	0.16	0.28	0.48	1.06
[illegible]	[illegible]	[illegible]	33.0	0.14*	0.23*	0.70	0.92	1.38

TABLE 1. (CONT)

Run No.	Inlet conditions: Gas total temperature (°F)	Total pressure (psia)	Static pressure (psia)	Mach number	Reynolds number x 10^{-6}	Exit conditions: Mach number	Reynolds number x 10^{-6}	Expansion ratio
166	818	59.2*	57.9	0.18*	0.52*	0.71	1.65	1.38
168	788	62.5*	62.2	0.08*	0.25*	0.30	0.91	1.06
169	822	45.0*	44.0	0.18*	0.39*	0.69	1.23	1.36
170	807	56.8*	54.9	0.22*	0.62*	1.06	1.85	2.01
171	787	56.4*	54.0	0.26*	0.71*	1.05	1.87	1.98
172	800	33.9*	32.8	0.21*	0.36*	0.70	0.96	1.38
173	787	45.2*	43.7	0.22*	0.50*	0.71	1.30	1.38
174	780	59.8*	57.9	0.22*	0.65*	0.69	1.69	1.36

*Distorted inlet runs require special handling of these values (see text).

2.2 DESCRIPTION OF SUMMARY DATA

A total of eight summary data items, listed in Table 2, are available for the linear cascade runs.

TABLE 2. LINEAR CASCADE SUMMARY DATA ITEMS

1. Aero summary sheet
2. Heat transfer endwall hotside temperature contours
3. Endwall passage pressure contours
4. Adiabatic endwall temperature contours
5. Heat transfer endwall Stanton number contours
6. Vane V/V_c plots
7. Exit flowfield aero summary plots
8. Inlet flowfield temperature and velocity profiles

Not all data items are available for all runs. Some runs, as explained in Volume I, contain only heat transfer data with no exit aero survey available. Similarly, the baseline "cold" aero runs contain no heat transfer data. In addition, some data sets are formed from a composite of runs. This resulted from instrumentation problems during a run creating erroneous results for a portion of the data. Only the portion that was affected was repeated, thereby creating data sets consisting of results from more than one run, but with all runs made at identical run conditions. Table 3 lists the data items that are available for each run, and where data sets are a composite of more than one run, the additional run numbers are given.

The individual data items will be discussed to explain how they were developed and what the format of each item is.

TABLE 3. AVAILABILITY OF SUMMARY DATA FOR LINEAR CASCADE

Page Nos.	Run No.	Run Conditions	Aero Summary Table	Endwall Temperature Contours	Endwall Pressure Contours	Adiabatic Temperature Contours	Endwall Stanton No. Contours	Vane V/V_{crit} Plot	Exit Aero Summary Plots	Inlet Profiles
10-13	57	X	X		X			X	X	
14-17	61	X	X		X			X	X	
18-21	67	X	X		X			X	X	
22-29	86*	X	X	96	96	96	96	X	X	177
30-36	87*	X	X	95	95	95	95	X	X	
37-44	89*	X	X	93C	93C	93C	93C	X	X	176
45-52	91*	X	X	X	X	X	X	X	X	179
53-57	94	X		X	X	X	X			
59-72	98	X		X	X	X	X			
63-69	99	X	X	X	X	X	X	X	X	
70-74	105	X	X		X	X		X	X	
75-79	107	X	X		X	X		X	X	
80-84	108	X	X		X	X		X	X	
85-91	109	X	X	X	X	X	X	X	X	
92-98	111	X	X	X	X	X	X	X	X	
99-105	112	X	X	X	X	X	X	X	X	
106-112	113	X	X	X	X	X	X	X	X	
113-119	114	X	X	X	X	X	X	X	X	
120-127	116	X	X	X	X	X	X	X	X	
128-133	118	X		X	X	X	X			
134-141	122	X	X	X	X	X	X	X	X	X
142-149	123	X	X	X	X	X	X	X	X	X
150-157	124	X	X	X	X	X	X	X	X	X
158-163	131*	X		X	X	125	X			125
164-169	132	X		X	X	X	X			X
170-175	133	X		X	X	X	X			X
176-181	149	X		X	X	X	X			X
182-187	150	X		X	X	X	X			X
188-193	165	X		X	X	X	X			X
194-199	166	X		X	X	X	X			X
200-205	168	X		X	X	X	X			X
206-211	169	X		X	X	X	X			X
212-217	170	X		X	X	X	X			X
218-223	171	X		X	X	X	X			X
224-229	172	X		X	X	X	X			X
230-235	173	X		X	X	X	X			X
236-241	174	X		X	X	X	X			X

*Results of this run are a composite of runs at identical conditions. Run numbers of additional runs are given where data is used.

2.2.1 Aero Summary Sheet

This data sheet includes the pertinent inlet and exit conditions that were used to set up the run. These include the inlet total pressure, static pressure, total temperature, Mach number, V/V_c, and Reynolds number based on true chord. The ideal exit conditions are also given on the summary sheet. The same parameters as given for the inlet are listed for the exit. The ideal exit values are based on measured exit static pressures and the isentropic flow assumption. The summary sheet also gives the cascade expansion ratio and static pressure ratio.

A summary of the exit flow field traverse data is given in the form of mixed-out conditions for each span position at which data was taken. The method for calculating mixed-out properties assumes that a hypothetical uniform property state exists downstream of the cascade. It then solves conservation equations between cascade exit and mixed-out state for the unknown mixed-out parameters. The equations solved conserve energy, mass, axial momentum and tangential momentum, and require an iterative solution. One side of each equation is an integral, which may be evaluated from test data, and the other side contains only mixed-out variables.

The mixed-out variables listed include the mass flow per passage in lb/sec, the total pressure in psia, the total temperature in °F, the Mach number, the exit gas angle, the pressure loss coefficient based on ideal dynamic pressure, and the kinetic energy loss coefficient.

2.2.2 Heat Transfer Endwall Temperature Contours

The 53 measured hotside passage temperatures on the endwall are curve fit, then used to obtain interpolated temperatures for the nodes of the finite element model. The finite element program can generate contour plots from node values of a given variable. Using this capability, the interpolated hotside temperatures in °F at each node are contour plotted to provide the heat transfer endwall temperature contours.

2.2.3 Endwall Passage Pressure Contours

The 42 endwall static pressure values in psia are used to generate pressure values for the 338 nodes of the endwall finite element model, using an interpolation algorithm identical to that used for the endwall temperature. Similarly, these interpolated node pressures are then used to generate a contour plot using the plotting routine from the finite element program.

2.2.4 Adiabatic Endwall Temperature Contours

Similar to the two preceding plots, this contour plot is developed by curve fitting the 90 adiabatic endwall temperature measurements in °F, interpolating the results to determine values at each of the 338 nodes of the endwall finite element model. The results are then contour plotted by the finite element plotting routine.

2.2.5 Endwall Stanton Number Contours

This contour plot is developed by using the local endwall heat transfer coefficient that is determined at each node by the finite element solution technique. The Stanton number is calculated at each node, based on the heat transfer coefficient at that node and the average inlet flow conditions. These values are then contour plotted by the finite element plotting routine.

The sign convention on the heat flux was changed for run 149 and all subsequent runs. This was done to eliminate the negative Stanton numbers shown on runs prior to 149. In comparing data from different runs, all Stanton numbers should be considered positive and for runs prior to 149, the MAX and MIN locations and values shown on the contour plots should be reversed.

2.2.6 Vane V/V_c Plots

Static pressure measurements were made on the suction and pressure surfaces of cascade airfoils at 5%, 20%, and 50% of span. These local static pressures were then used to calculate local values of V/V_c based on an upstream total pressure read from one element of the inlet core pressure rake. These values of V/V_c at the three spanwise positions were then plotted as a function of percent axial chord.

2.2.7 Exit Flowfield Aero Summary Plots

This sheet contains four plots that summarize the exit traverse results. The pressure loss coefficient and exit air angle are plotted as a function of percent span. The values are the mixed-out values previously tabulated on the aero summary sheet.

Also shown are local contour plots of the pressure loss coefficient and the air turning angle. The pressure loss coefficient plot shows the contour representing changes in level from the wall out to midspan, and also in the circumferential direction across the passage. A similar contour plot for the air angle gives contours for the difference between the local air turning angle and the mixed-out value at each span location.

2.2.8 Inlet Temperature and Velocity Profiles

The data for these plots were taken with the traversing inlet probe described in Section 3 of Volume I. Measurements of temperature and pressure were made upstream of the cascade from the endwall out to midspan, with added emphasis placed on the boundary layer region.

The temperature data that are plotted are an average of several readings. This is done to eliminate variations due to slight fluctuations in the gas temperature. All temperature data plotted are in °F.

Similarly, pressure measurements represent an average of several readings and, in addition, are time corrected based on changes in inlet reference total pressure. The pressure measurements are then used with a probe calibration and inlet static pressure measurements to calculate inlet velocities. These velocities, in ft/sec, are then plotted from the wall out to midspan.

2.3 DATA SUMMARY

This section contains the data summary sheets for all linear cascade tests with the exception of the inlet turbulence measurements. The results are arranged in numerical order of run number as listed in Table 3. Recall that not all data items are available for all runs.

LINEAR CASCADE DATA

GMA 200 TURBINE VANE CASCADE

RUN # 57 DATE: 01/03/79 TIME: 2:14:45

INLET CONDITIONS

PTOTAL	PSTATIC	TTOTAL	MACH #	V/V*	REY/10**6
21.41	20.90	656.85	.186	.203	.429

IDEAL EXIT CONDITIONS

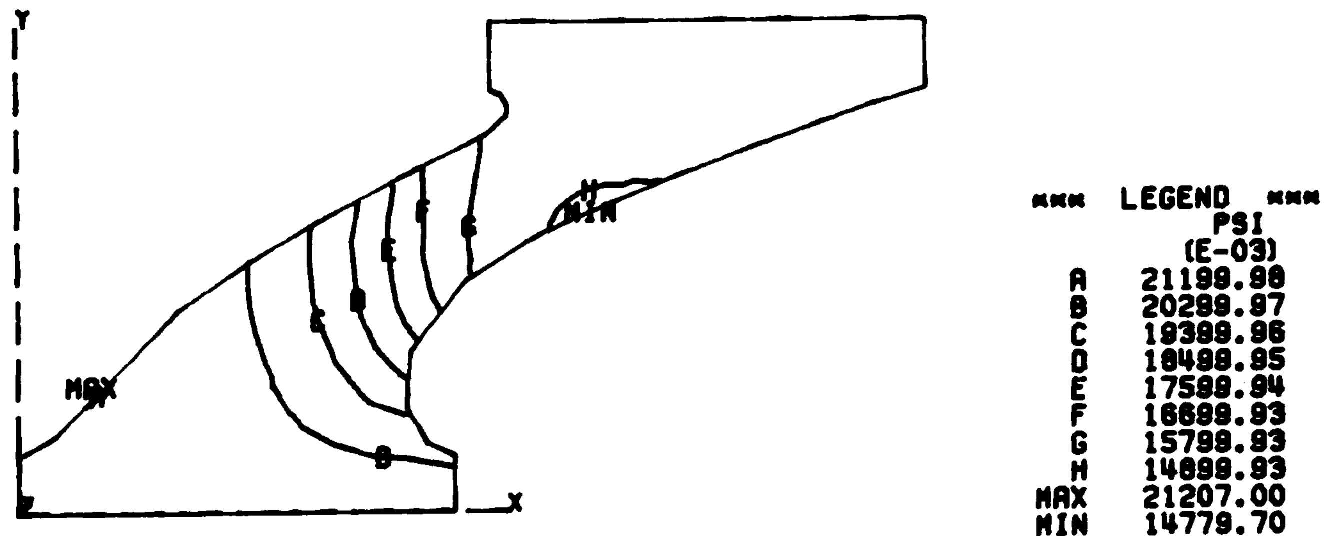
PTOTAL	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
21.41	15.26	656.85	.713	.744	1.345

CASCADE OPERATING CONDITION

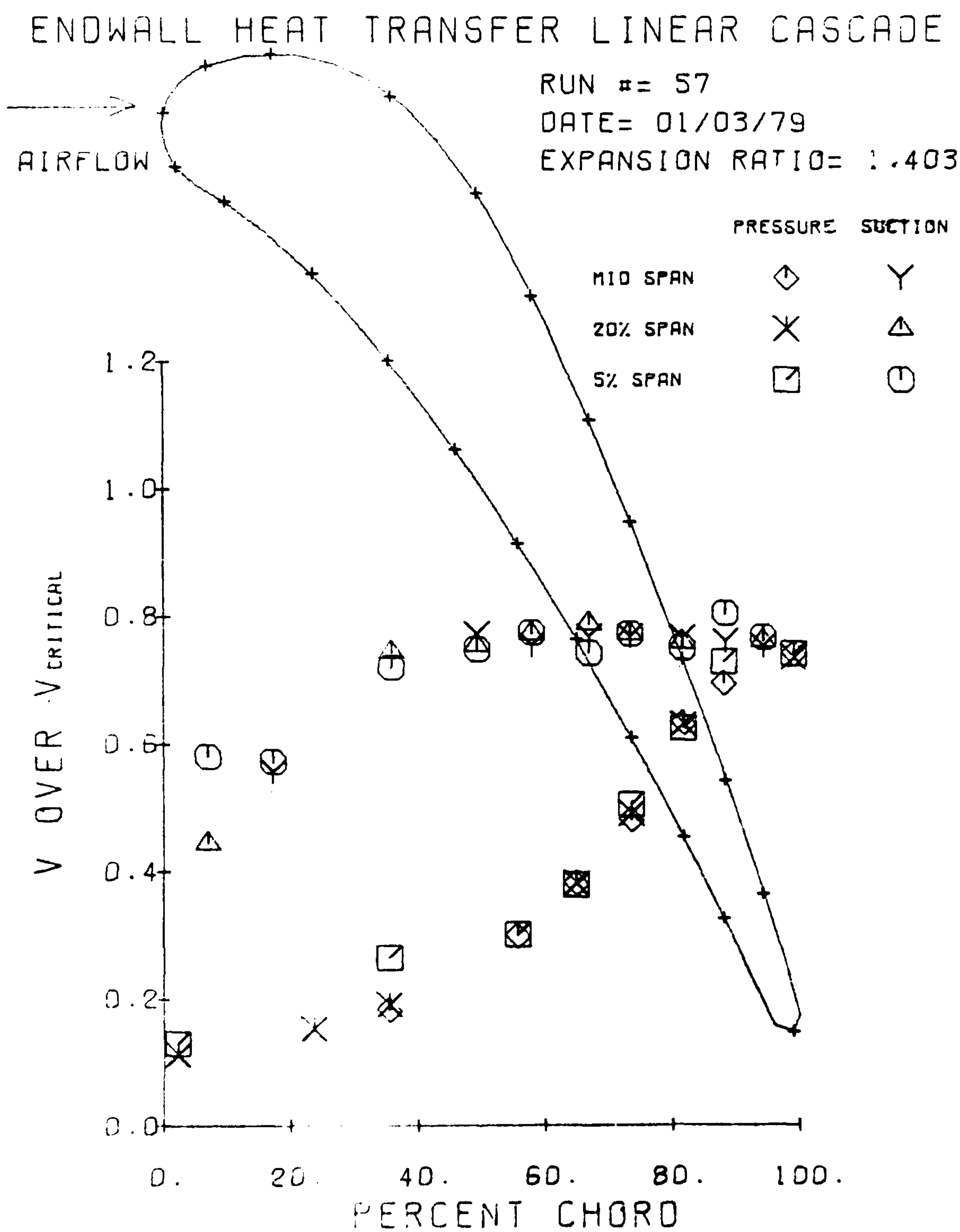
EXPANSION RATIO = 1.403 STATIC PRESSURE RATIO = .730

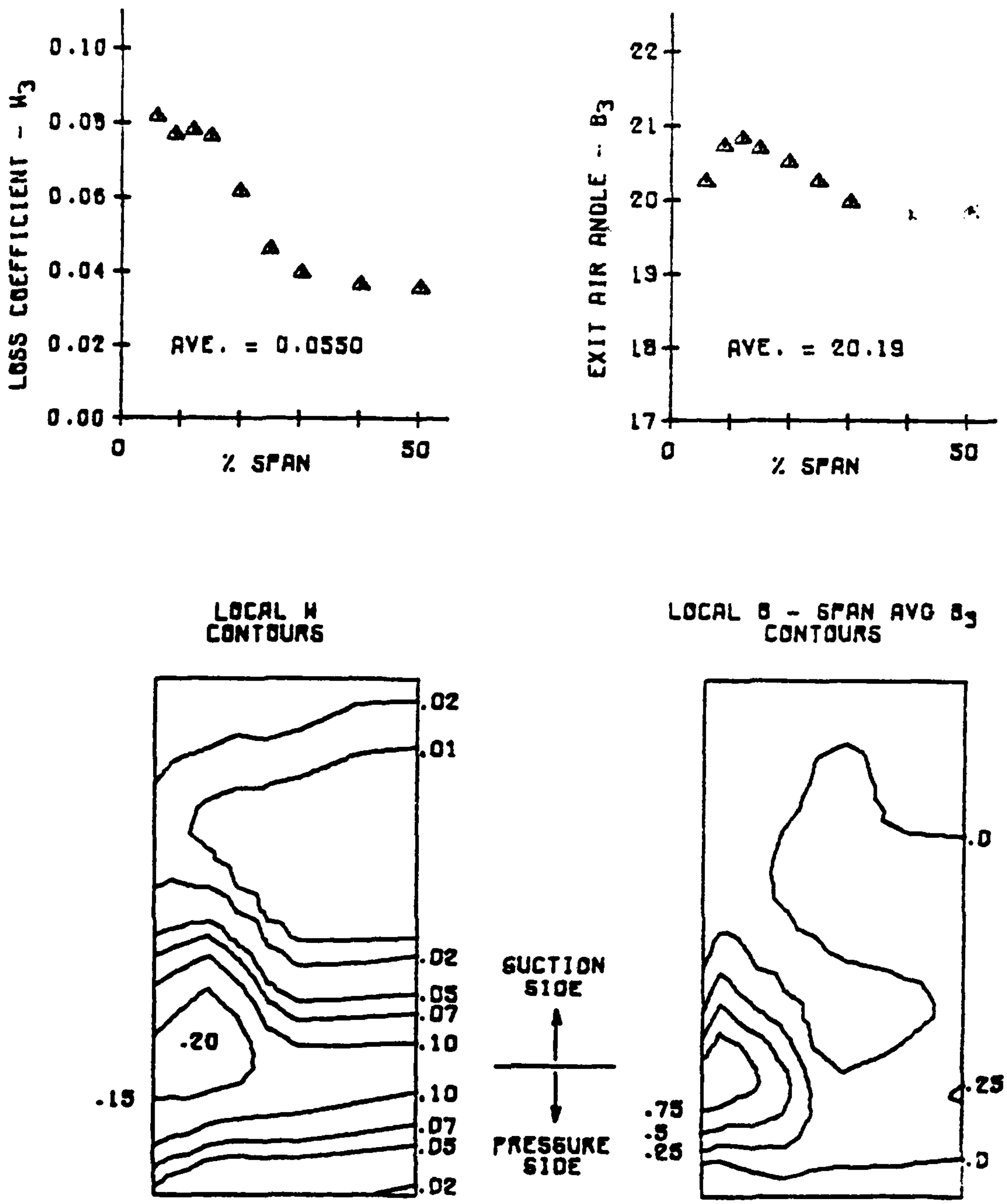
*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.2	1.083	21.19	657.	.699	19.82	.0356	.0290
40.1	1.076	21.18	659.	.697	19.75	.0364	.0297
30.1	1.086	21.17	660.	.695	19.97	.0395	.0322
25.1	1.098	21.13	661.	.693	20.25	.0459	.0375
20.1	1.101	21.03	661.	.687	20.50	.0615	.0505
15.1	1.099	20.95	661.	.679	20.68	.0763	.0628
12.1	1.099	20.95	661.	.671	20.82	.0778	.0644
9.0	1.084	20.96	662.	.659	20.72	.0767	.0639
6.1	1.032	20.97	662.	.626	20.25	.0815	.0690
AVERAGE	1.080	21.08	660.	.680	20.19	.0550	.0454



RUN 57
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 9:02:38 81/049


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 57
DATE= 01/03/79
EXPANSION RATIO= 1.403
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.71 REYNOLDS NO. = 1.35×10^6

RUN 57 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN # 01 DATE: 01/03/79 TIME: 3:41:22

INLET CONDITIONS

[illegible]TOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
[illegible].53	36.51	656.25	.199	.217	.8[illegible]6

IDEAL EXIT CONDITIONS

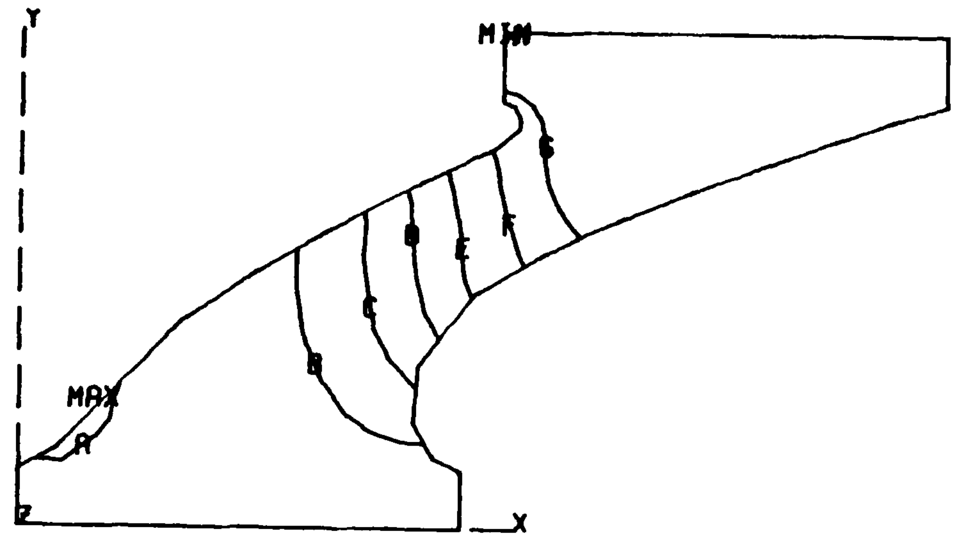
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
37.53	17.62	656.25	1.099	1.080	2.784

[illegible]CADE OPERATING CONDITION

EXPANSION RATI[illegible] 2.130 STATIC PRESSURE RATIO= .483

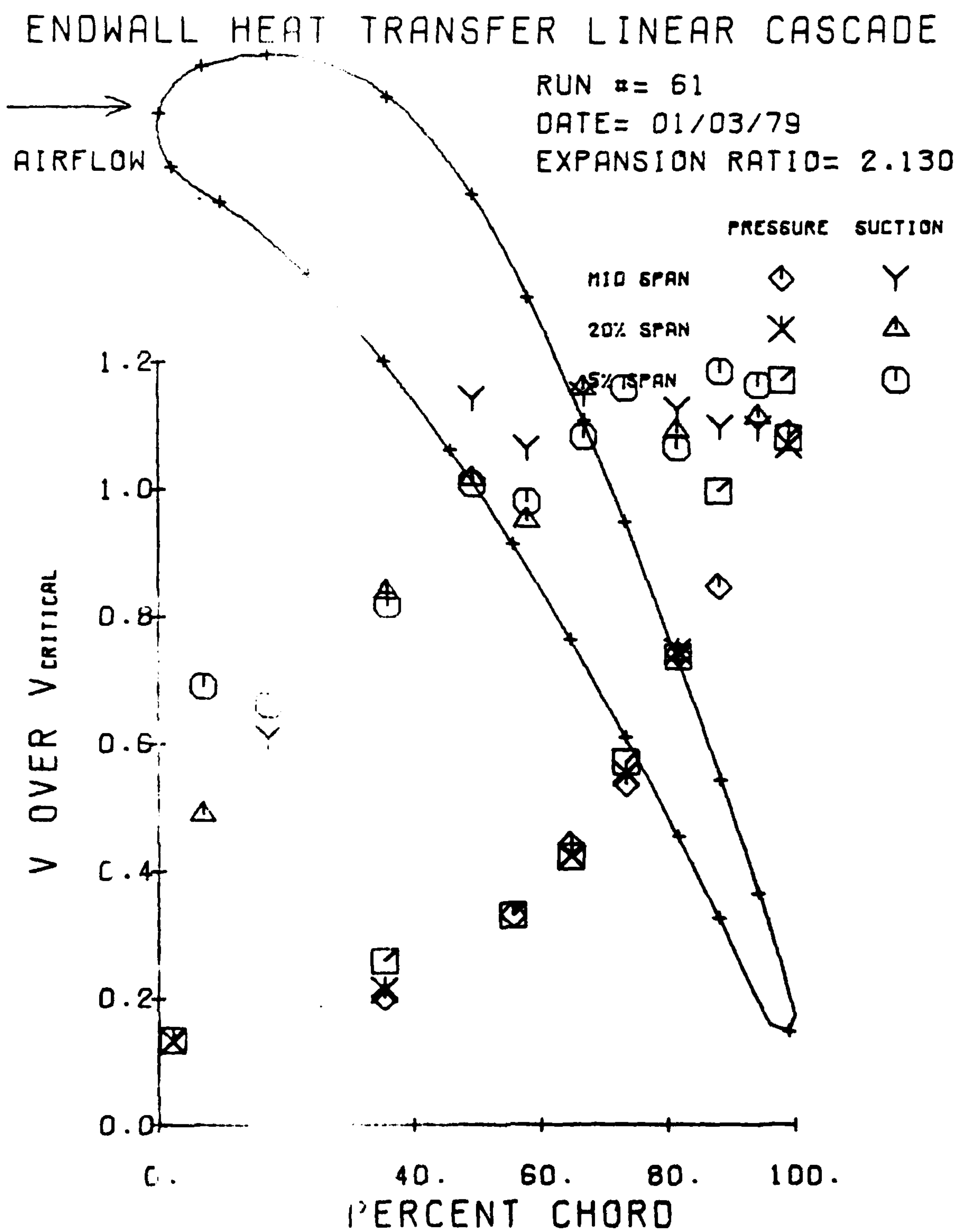
*** [illegible]IXED OUT CONDITION SUMMARY ***

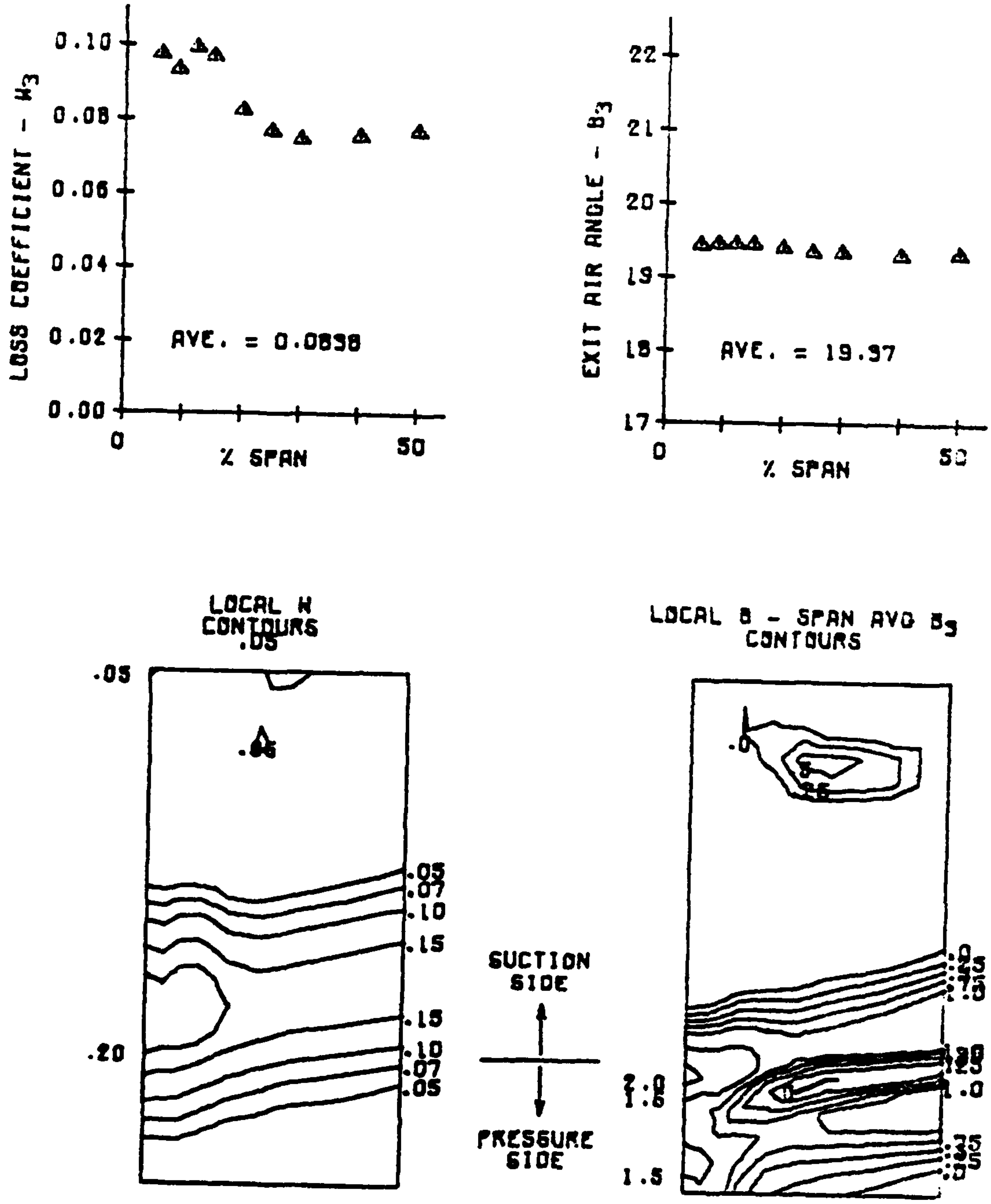
% SPAN	MASS	[illegible]	TT3	M3	BETA3	OMEGA	EBAR
50.1	1.974	36.[illegible]	653.	1.023	19.33	.0772	.0514
40.0	1.969	36.[illegible]	655.	1.029	19.30	.0756	.0501
30.1	1.973	36.1[illegible]	657.	1.027	19.33	.0750	.0497
25.0	1.971	36.07	658.	1.024	19.35	.0768	.0511
20.1	1.970	35.97	657.	1.018	19.39	.0823	.0549
15.1	1.966	35.7[illegible]	654.	1.007	19.44	.0967	.0650
12.0	1.959	35.[illegible]	657.	1.004	19.44	.0991	.0668
9.1	[illegible].962	35.7[illegible]	658.	1.011	19.43	.0931	.0624
5.9	1.955	35.[illegible]	657.	1.019	19.42	.0973	.0649
AVERAGE	1.967	35.[illegible]	656.	1.021	19.37	.0830	.0555



*** LEGEND ***	PSI
A	37.00
B	34.00
C	31.00
D	28.00
E	25.00
F	22.00
G	19.00
H	16.00
MAX	37.11
MIN	15.62

RUN 61
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:08:15 81/049


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 61
DATE= 01/03/79
EXPANSION RATIO= 2.130
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 1.10 REYNOLDS NO. = 2.75 X 10^6

<u>RUN 61 AERODYNAMIC EXIT DATA</u>

GMA 200 TURBINE VANE CASCADE

RUN # 57 DATE: 01/09/79 TIME: 4:24:55

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
15.50	15.29	684.66	.142	.155	.227

IDEAL EXIT CONDITIONS

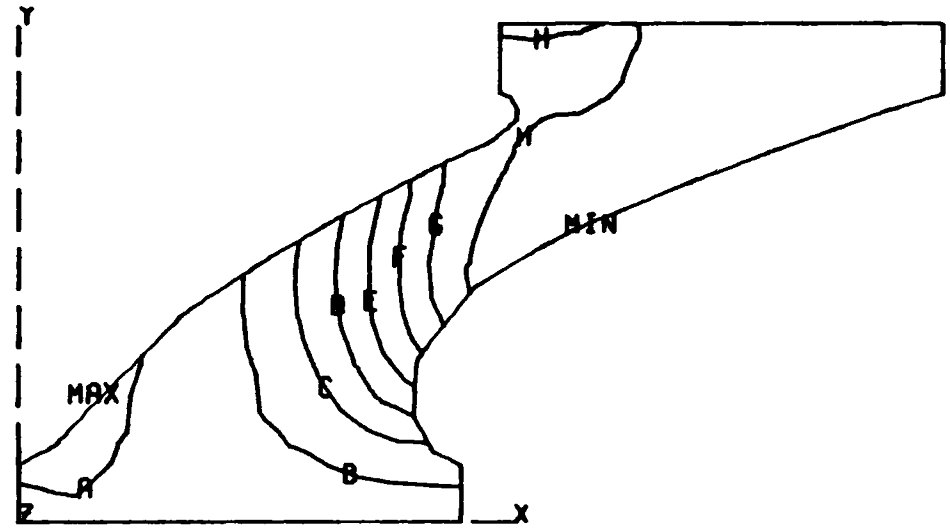
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
15.50	14.59	684.66	.296	.321	.459

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.062 STATIC PRESSURE RATIO= .955

*** MIXED OUT CONDITION SUMMARY ***

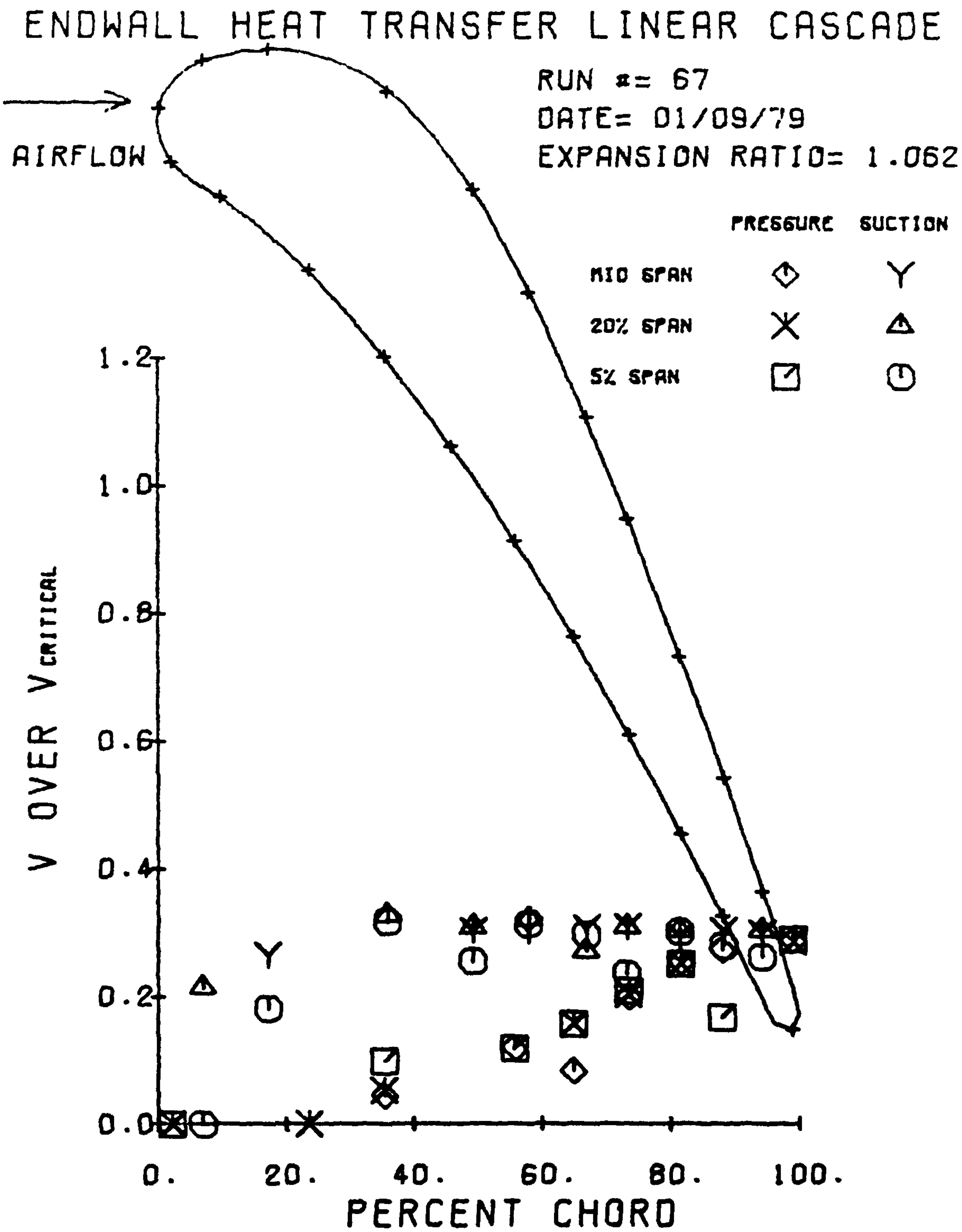
% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.1	.398	15.47	683.	.270	20.85	.0376	.0364
40.1	.397	15.47	683.	.270	20.80	.0400	.0388
30.1	.399	15.46	683.	.268	20.99	.0465	.0450
25.1	.400	[illegible]	683.	.266	21.22	.0597	.0578
20.1	.399	[illegible]	683.	.263	21.48	.0767	.0744
15.1	.400	[illegible]	683.	.263	21.56	.0804	.0780
12.0	.400	[illegible]	684.	.263	21.51	.0772	.0749
9.0	.392	[illegible]	684.	.262	21.12	.0768	.0764
6.0	.374	[illegible]	684.	.261	20.20	.0837	.0812
AVERAGE	.394		683.	.266	20.98	.0605	.0587



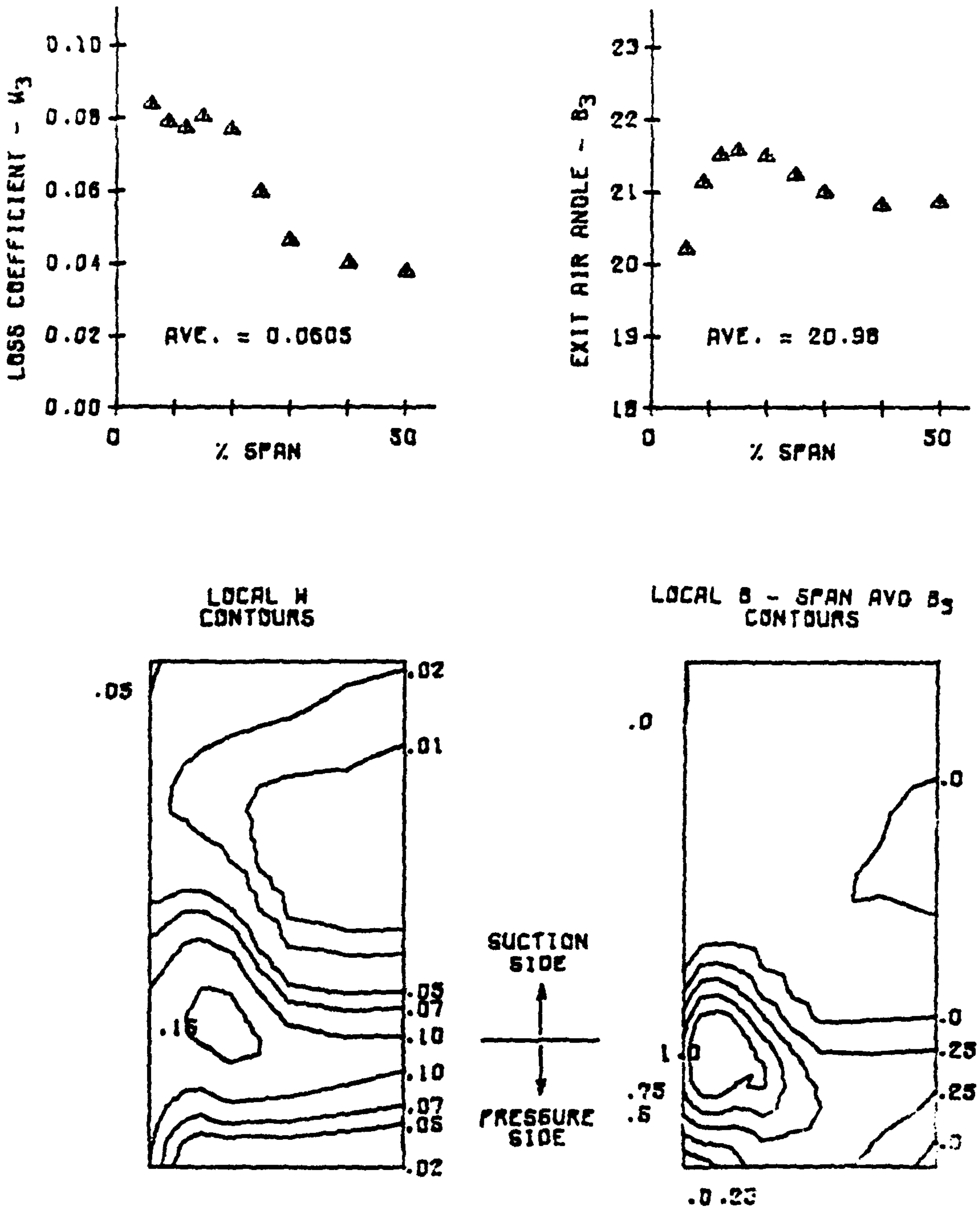
*** LEGEND ***
PSI
(E-03)

A	15499.99
B	15399.99
C	15299.99
D	15199.99
E	15099.99
F	14999.99
G	14899.99
H	14799.99
MAX	15517.31
MIN	14702.38

RUN 67
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:33:56 61/049



ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 67
DATE= 01/09/79
EXPANSION RATIO= 1.062
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.30 REYNOLDS NO. = 4.59 X 10^5

RUN 67 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN # 86 DATE: 10/10/79 TIME: 12:13:43

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
21.42	20.97	1274.34	.178	.193	.186

IDEAL EXIT CONDITIONS

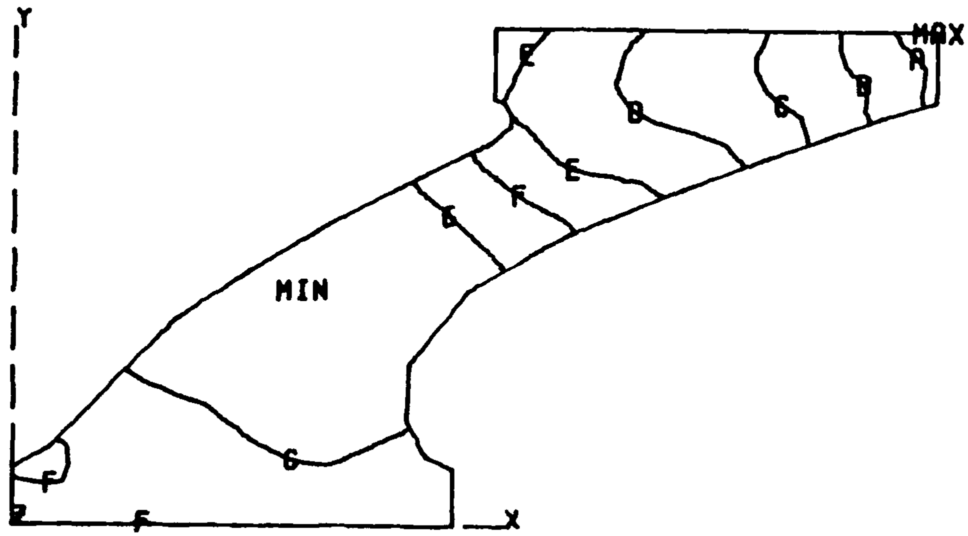
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
21.42	15.60	1274.34	.697	.726	.594

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.373 STATIC PRESSURE RATIO= .744

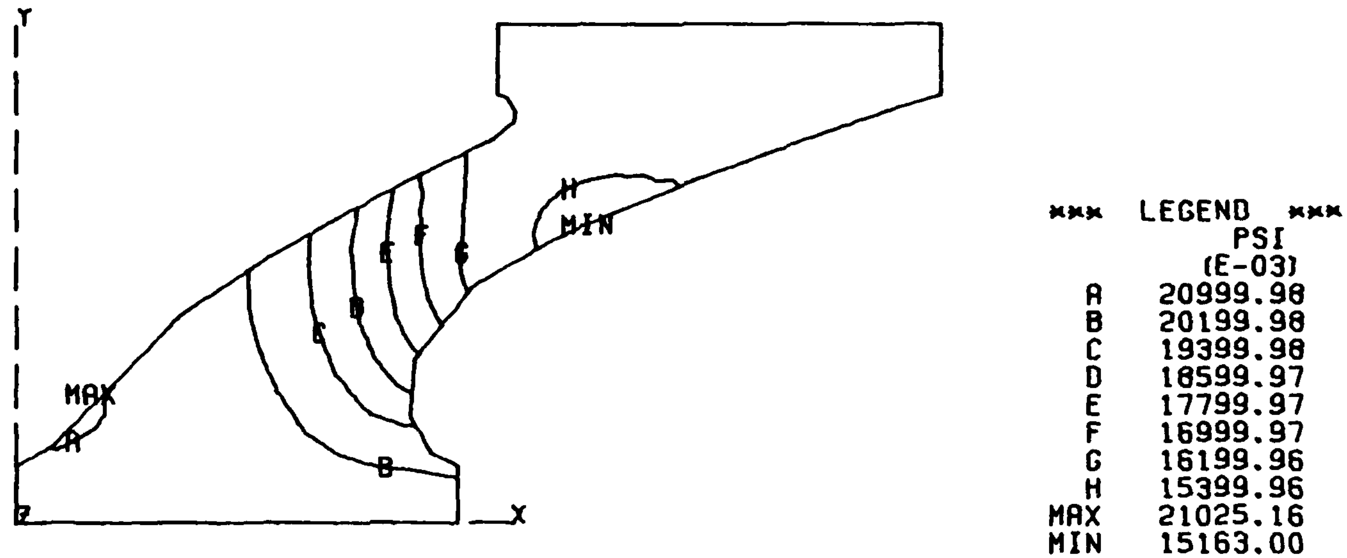
*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.0	.764	21.25	1217.	.585	19.19	.0290	.0240
39.8	.751	21.25	1240.	.685	19.06	.0300	.0248
29.9	.752	21.23	1247.	.686	19.15	.0323	.0267
24.9	.752	21.22	1255.	.686	19.26	.0346	.0286
20.0	.750	21.15	1242.	.682	19.19	.0465	.0385
14.8	.761	21.02	1234.	.675	19.68	.0685	.0570
11.9	.767	20.98	1222.	.672	19.84	.0763	.0635
8.5	.765	20.96	1233.	.671	19.90	.0791	.0659
6.3	.758	20.96	1216.	.670	19.58	.0788	.0656
AVERAGE	.756	21.14	1235.	.680	19.35	.0485	.0402

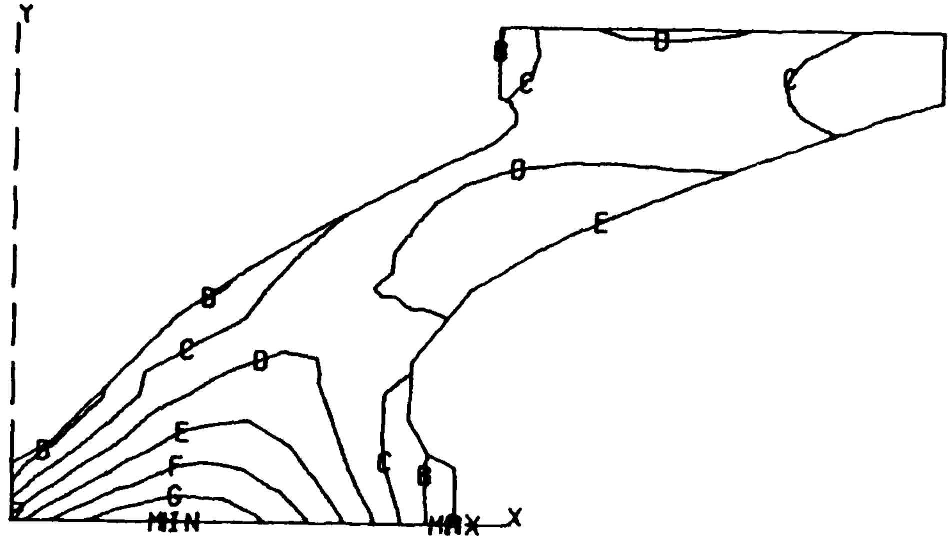


*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	5.10000E 02
B	5.00000E 02
C	4.90000E 02
D	4.80000E 02
E	4.70000E 02
F	4.60000E 02
G	4.50000E 02
MAX	5.16393E 02
MIN	4.42954E 02

RUN 96 MACH .7 TGAS 800. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:42:28 79/303



RUN 96 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:46:18 80/161



*** LEGEND ***

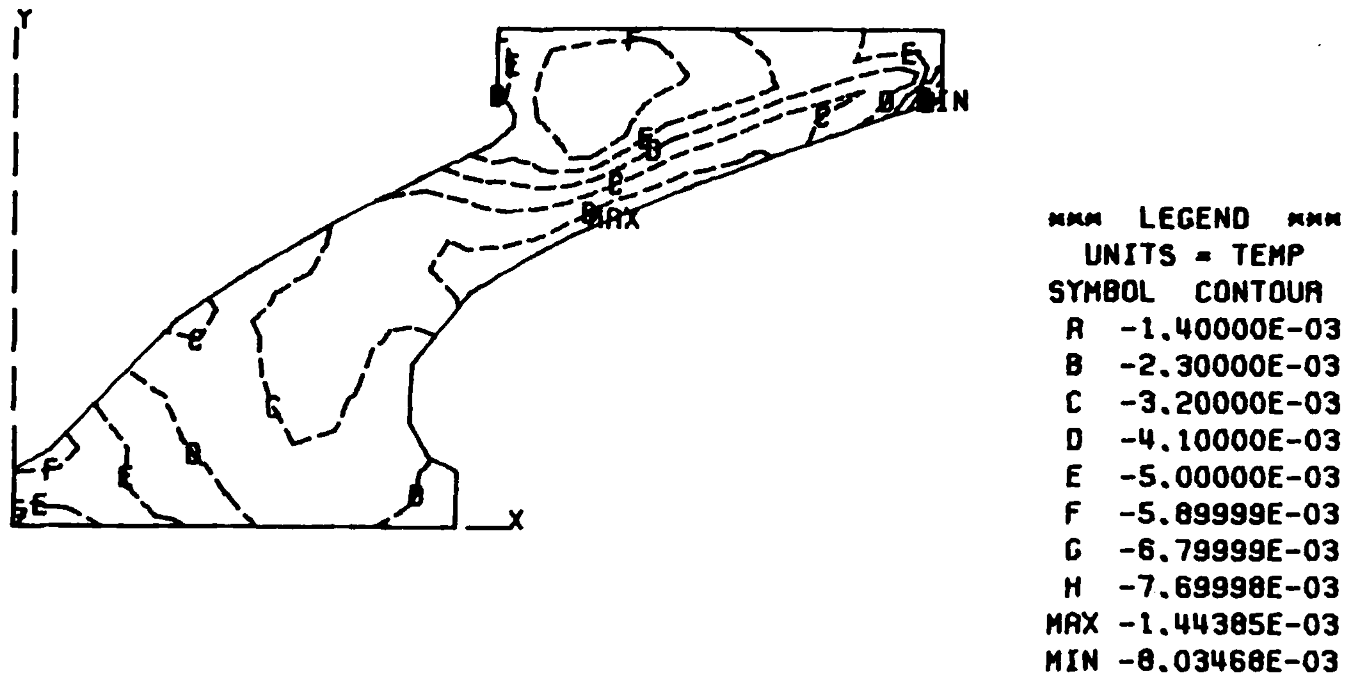
UNITS = TEMP

SYMBOL	CONTOUR
A	7.23000E 02
B	7.15000E 02
C	7.07000E 02
D	6.99000E 02
E	6.91000E 02
F	6.83000E 02
G	6.75000E 02
H	6.67000E 02
MAX	7.23760E 02
MIN	6.66820E 02

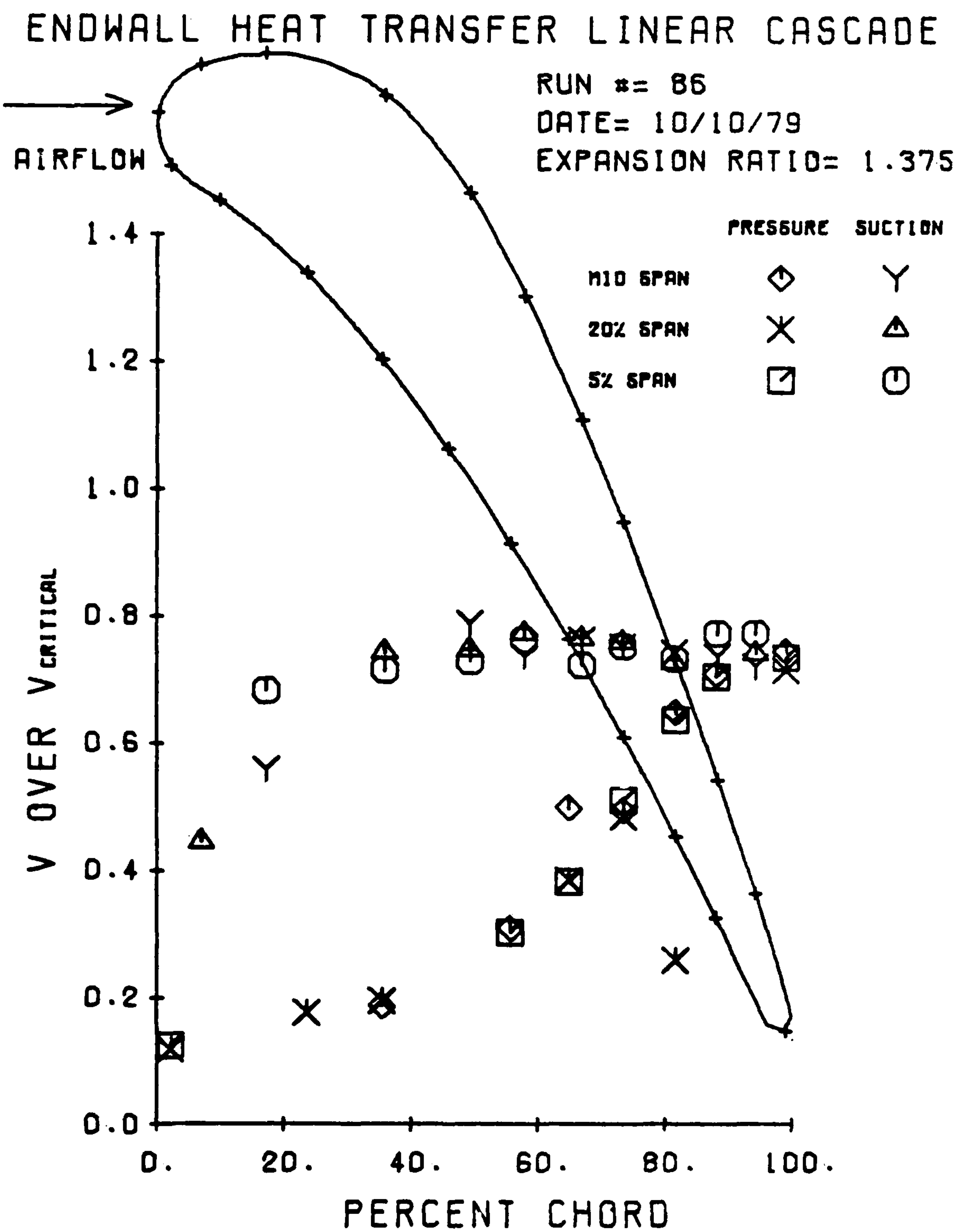
RUN 96 MACH .7 TGAS 800. ADIABATIC ENDWALL

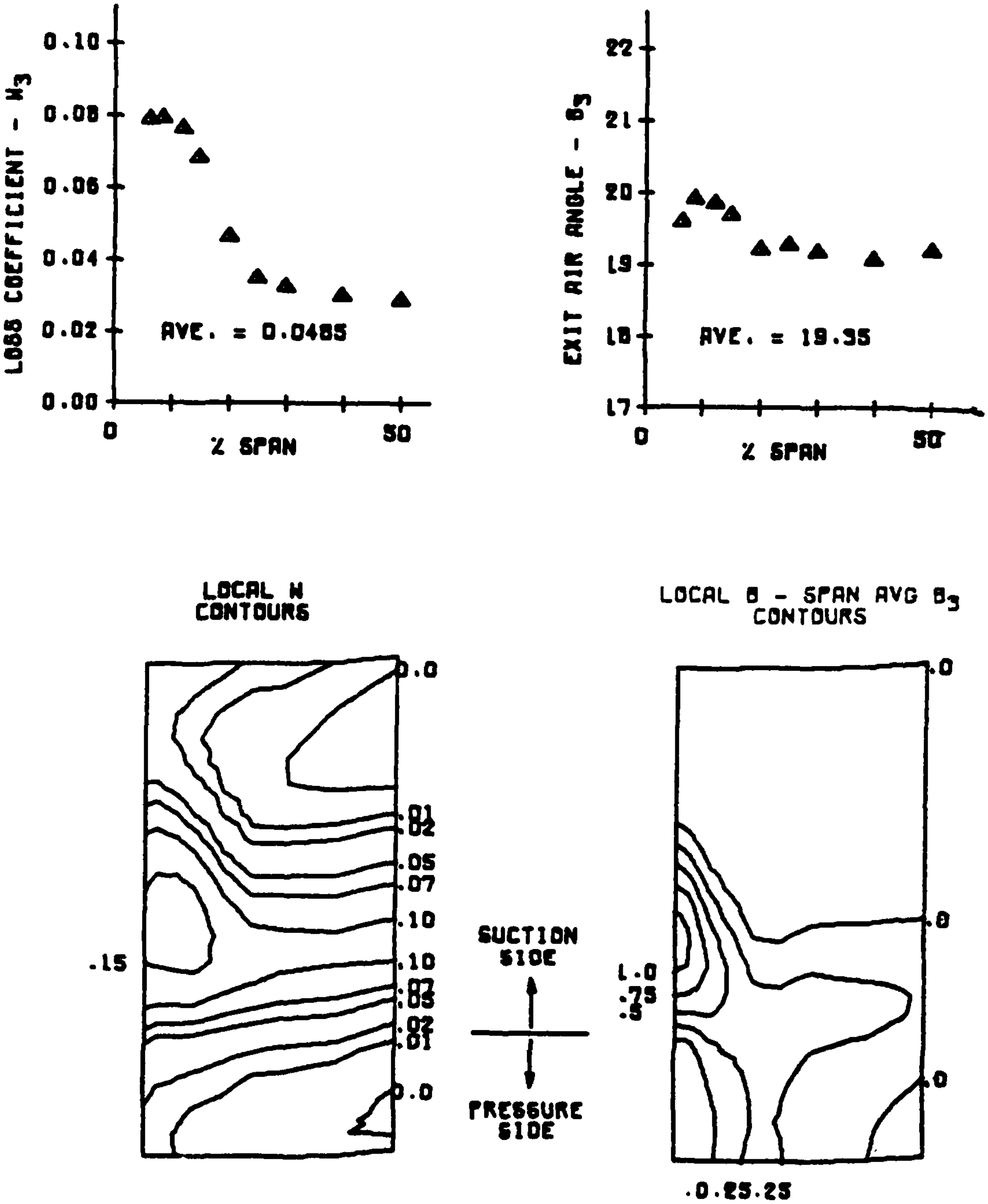
CONTOUR PLOT OF TEMPERATURE

SCALE = 1.0000 PLOT TIME AND DATE = 9:59:44 79/303



RUN 96 MACH .7 TGAS 800. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 12:47:43 79/303


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 86
DATE= 10/10/79
EXPANSION RATIO= 1.375
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD

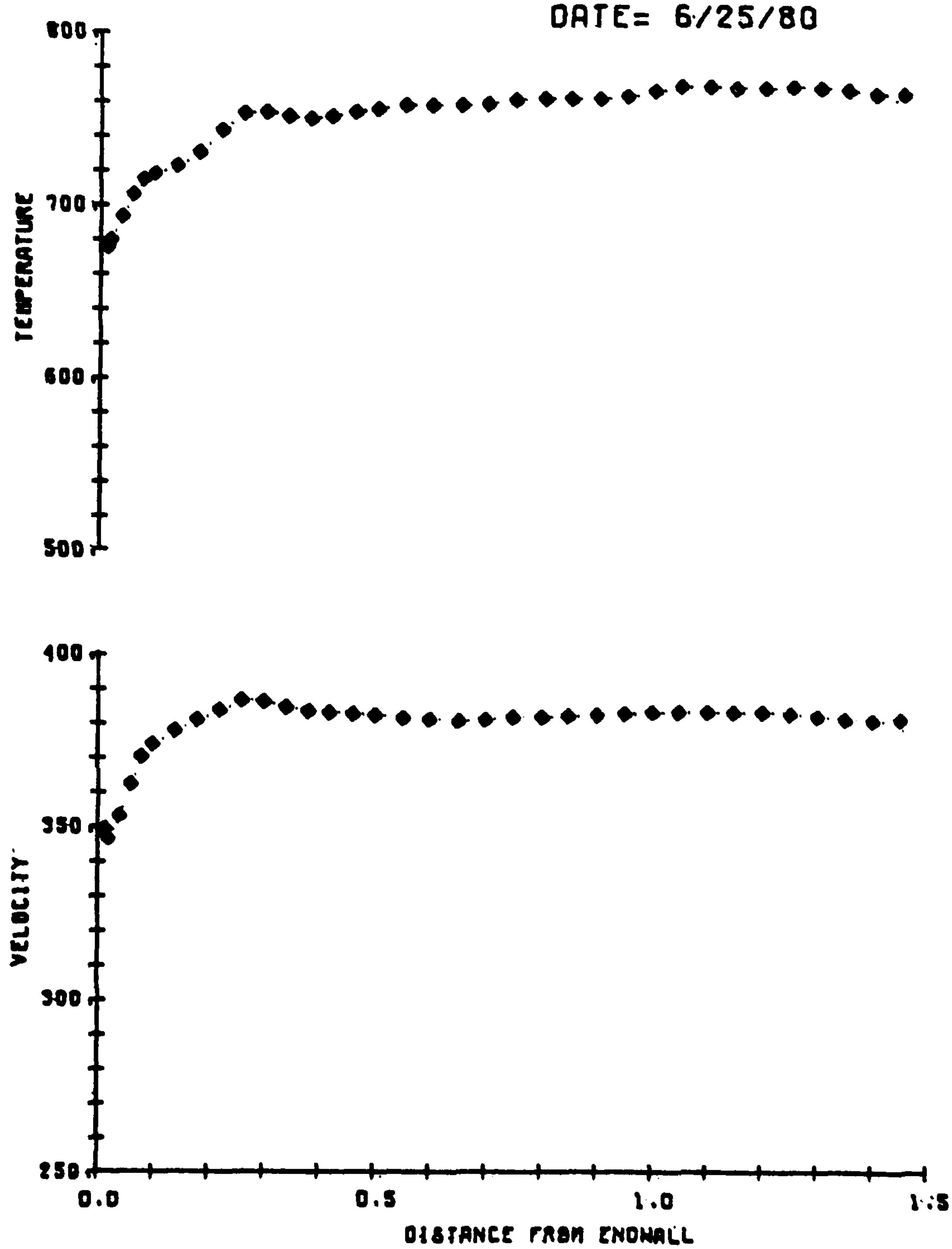


EXIT MACH NO. = 0.70 REYNOLDS NO. = 5.94 X 10^5

RUN 86 AERODYNAMIC EXIT DATA

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 177
DATE= 6/25/80



GMA 200 TURBINE VANE CASCADE

RUN # 87 DATE: 10/11/79 TIME: 7:51:40

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
21.59	21.11	1073.99	.180	.196	.232

IDEAL EXIT CONDITIONS

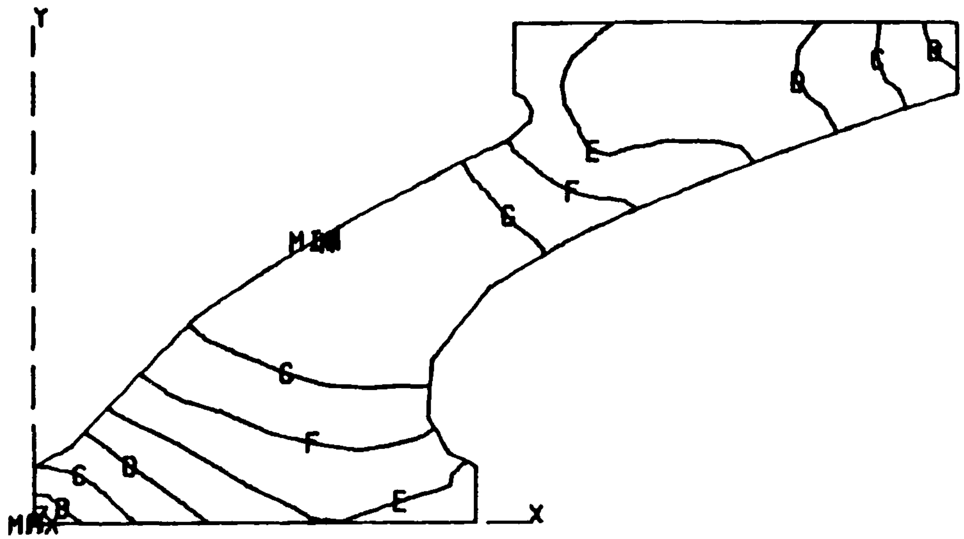
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
21.59	15.50	1073.99	.710	.740	.741

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.393 STATIC PRESSURE RATIO= .734

*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.0	.772	21.43	1041.	.697	17.63	.0259	.0212
39.8	.778	21.39	1033.	.705	17.63	.0316	.0258
29.9	.778	21.39	1042.	.704	17.68	.0315	.0257
24.9	.782	21.37	1031.	.703	17.76	.0344	.0281
19.8	.787	21.27	1031.	.697	17.97	.0520	.0426
14.7	.793	21.14	1035.	.689	18.40	.0731	.0602
11.9	.803	21.11	1021.	.687	18.57	.0780	.0643
[illegible].5	.799	21.10	1033.	.686	18.59	.0793	.0654
[illegible].8	.793	21.10	1008.	.690	18.17	.0792	.0651
AVERAGE	.785	21.28	1030.	.697	17.94	.0495	.0406

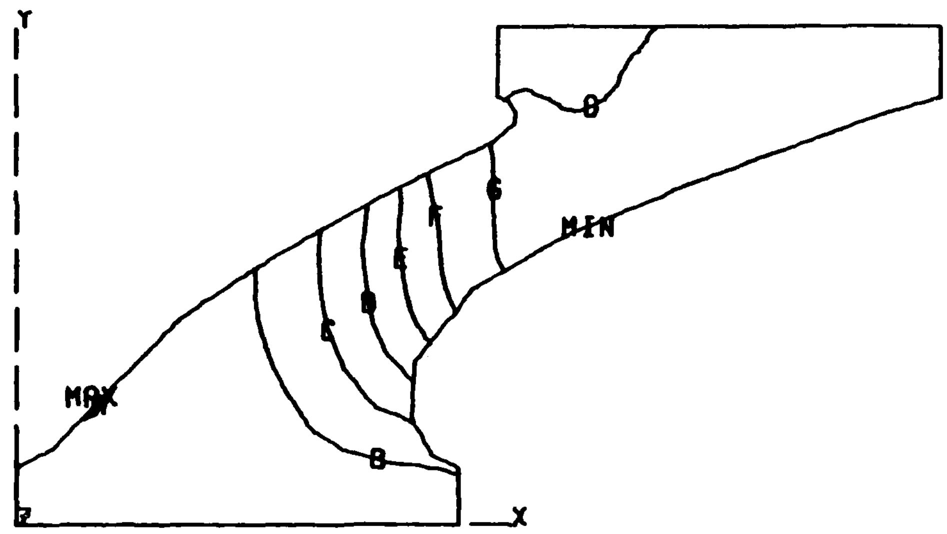


*** LEGEND ***

UNITS = TEMP

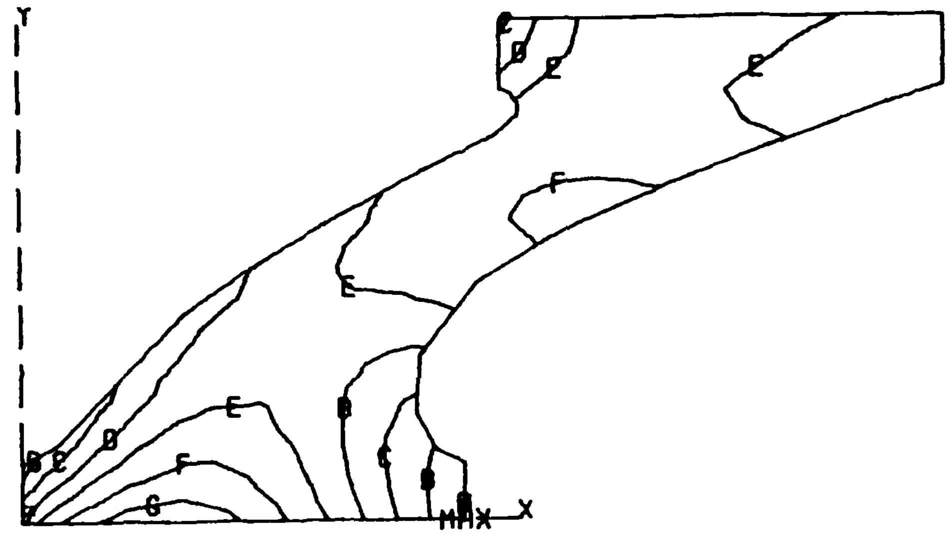
SYMBOL	CONTOUR
A	3.95000E 02
B	3.89000E 02
C	3.83000E 02
D	3.77000E 02
E	3.71000E 02
F	3.65000E 02
G	3.59000E 02
H	3.53000E 02
MAX	3.95469E 02
MIN	3.52921E 02

RUN 95 MACH .7 TGAS 600. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:23:53 79/303



*** LEGEND ***	
	PSI
	(E-03)
A	21999.98
B	20999.98
C	19999.98
D	18999.98
E	17999.98
F	16999.98
G	15999.98
MAX	22009.54
MIN	15277.69

RUN 95 MACH .7 TGAS 600 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 14:54:01 80/161

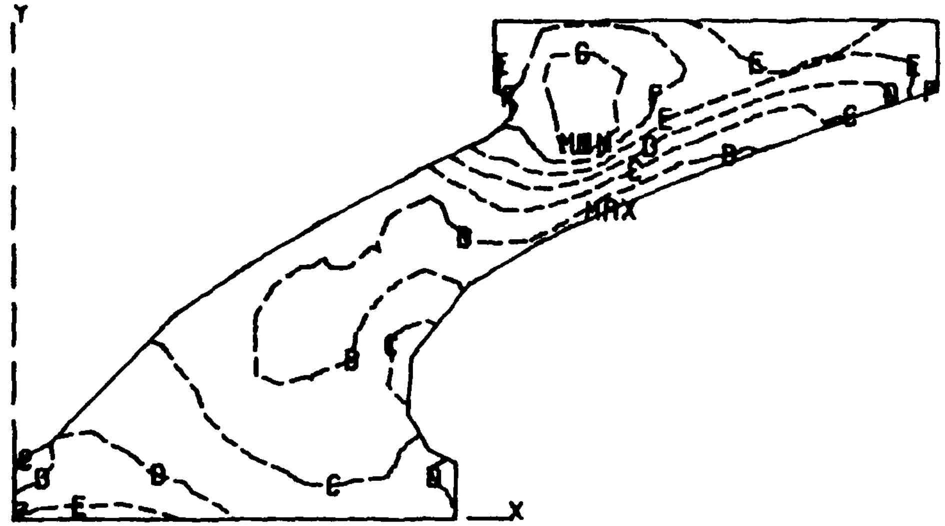


*** LEGEND ***

UNITS = TEMP

SYMBOL	CONTOUR
A	5.39000E 02
B	5.35000E 02
C	5.31000E 02
D	5.27000E 02
E	5.23000E 02
F	5.19000E 02
G	5.15000E 02
MAX	5.39376E 02
MIN	5.12283E 02

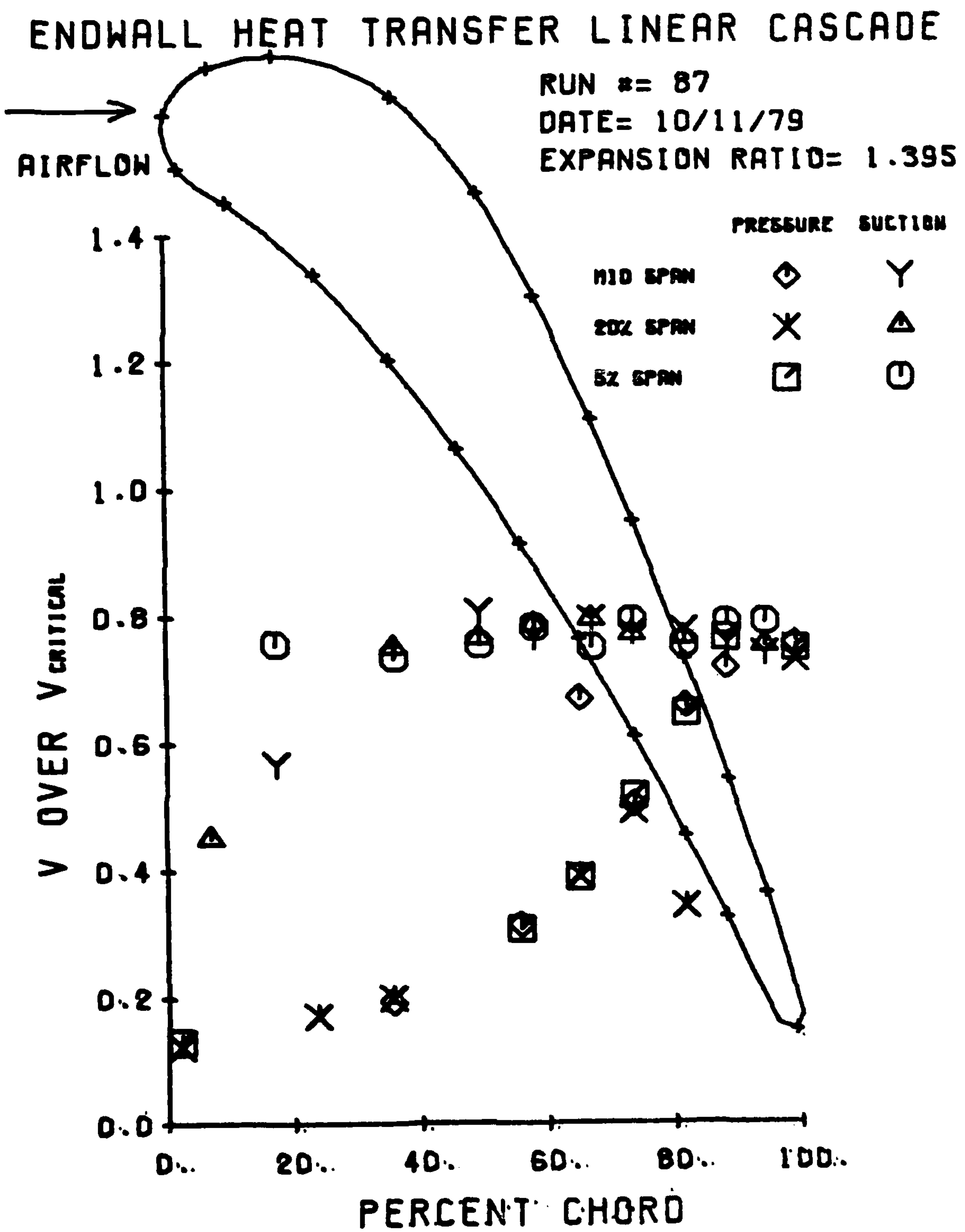
RUN 95 MACH .7 TGAS 600. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 9:46:19 79/303

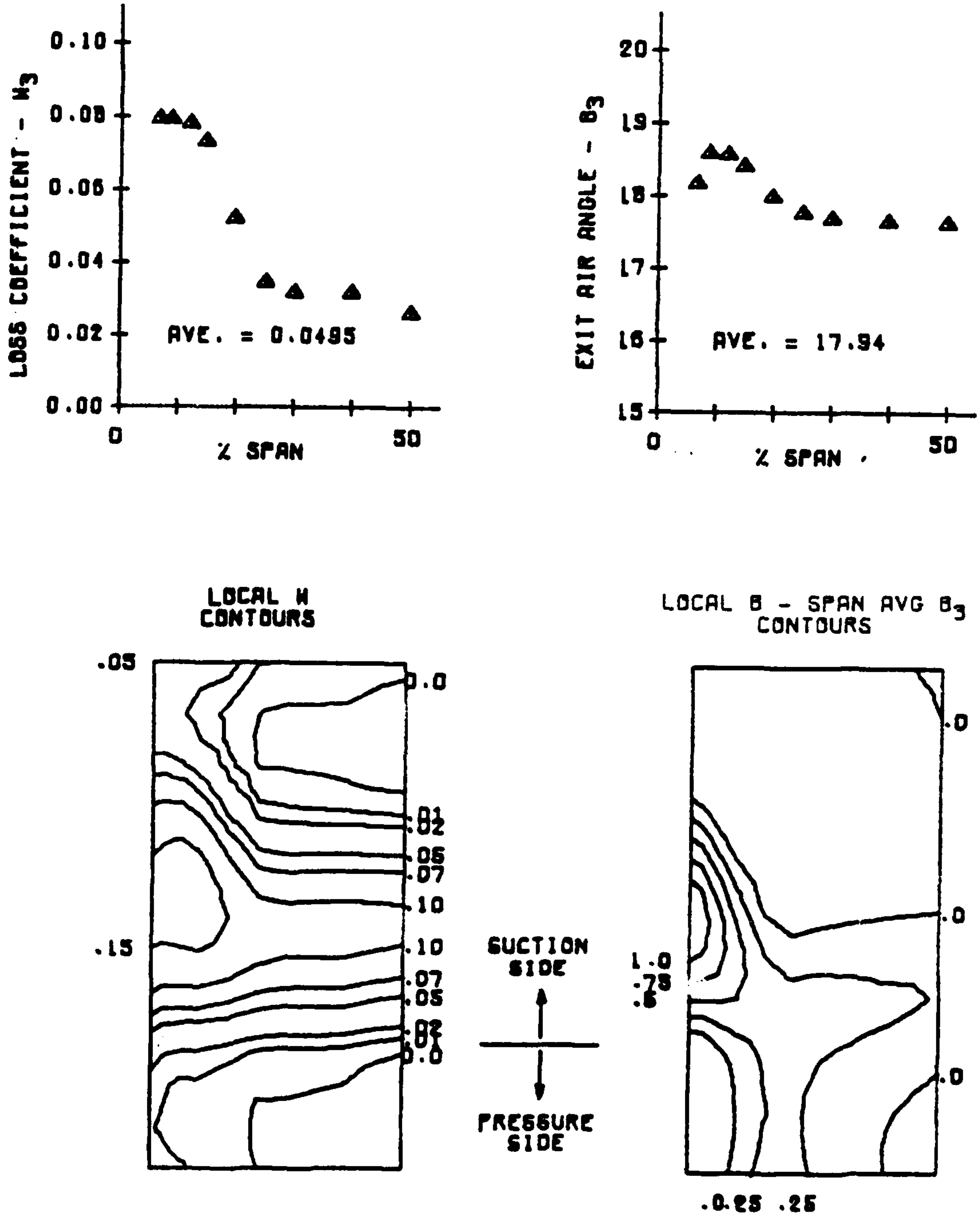


*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	-1.90000E-03
B	-2.70000E-03
C	-3.50000E-03
D	-4.30000E-03
E	-5.10000E-03
F	-5.89999E-03
G	-6.69999E-03
H	-7.49999E-03
MAX	-1.94118E-03
MIN	-7.56337E-03

RUN 95 MACH .7 TGAS 600. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 12:29:38 79/303


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 87
DATE= 10/11/79
EXPANSION RATIO= 1.395
AIRFLOW
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.71 REYNOLDS NO. = 7.41 X 10^5

<u>RUN 87 AERODYNAMIC EXIT DATA</u>

GMA 200 TURBINE VANE CASCADE

\# 59 DATE: 10/15/79 TIME: 14:14:27

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
15.42	15.34	1245.13	.090	.098	.070

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
15.42	14.68	1245.13	.270	.291	.205

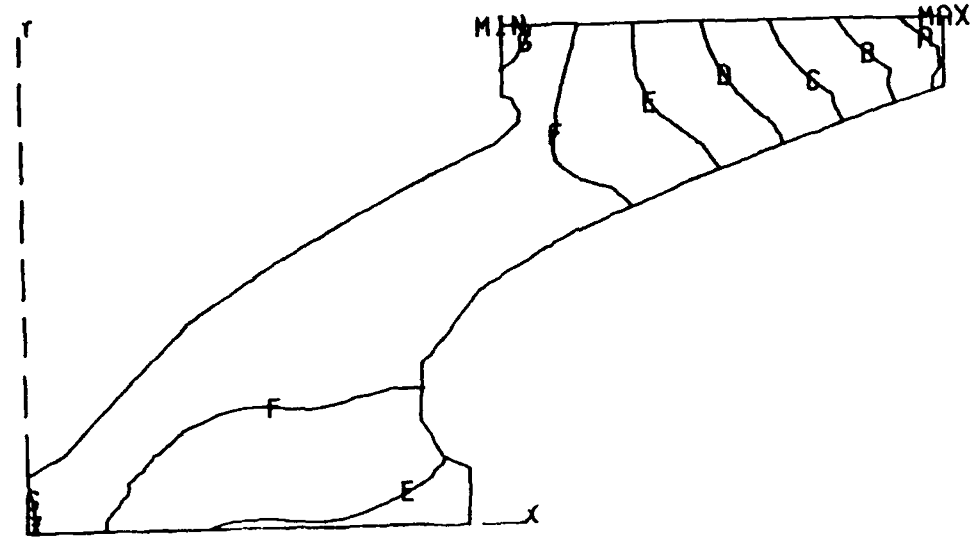
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.050 STATIC PRESSURE RATIO= .957

*** MIXED OUT CONDITION SUMMARY ***

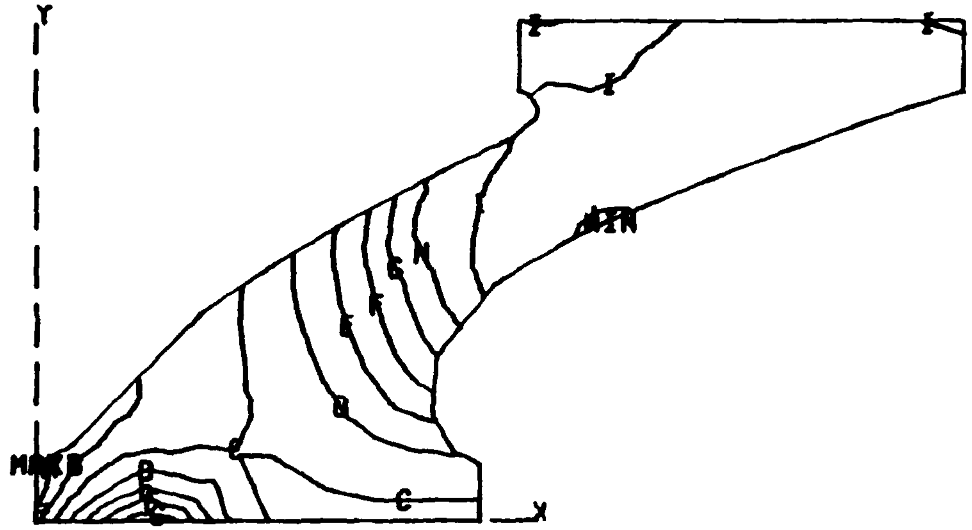
[illegible]	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
[illegible]	.263	15.39	1233.	.263	19.18	.0432	.0420
[illegible]	.266	15.39	1236.	.263	19.35	.0392	.0381
[illegible]	.265	15.39	1235.	.264	19.29	.0416	.0404
[illegible]	.264	15.39	1246.	.263	19.30	.0460	.0447
[illegible]	.262	15.38	1242.	.261	19.30	.0581	.0565
[illegible]	.263	15.36	1238.	.258	19.60	.0804	.0781
	.264	15.36	1223.	.257	19.61	.0823	.0800
	.262	15.36	1266.	.256	19.31	.0824	.0801
	.261	15.37	1189.	.256	19.21	.0805	.0787
	.254	15.38	1228.	.261	19.33	.0570	.0553

PRECEDING PAGE BLANK-NOT FILMED



***	LEGEND F	***
A	390.00	
B	380.00	
C	370.00	
D	360.00	
E	350.00	
F	340.00	
G	330.00	
MAX	396.40	
MIN	323.08	

RUN 93C MACH .27 TGAS 793. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 8:31:57 80/050

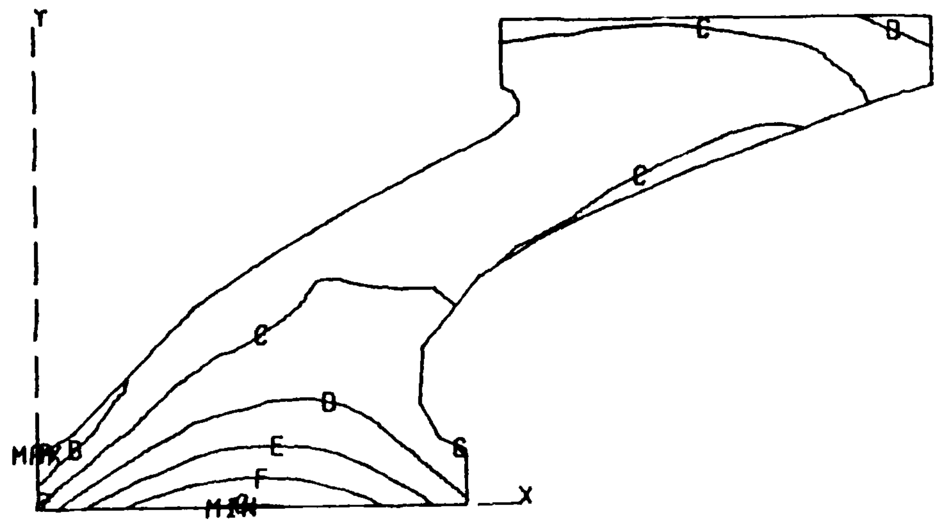


***	LEGEND ***
	PSI
	(E-03)
A	15499.99
B	15399.99
C	15299.99
D	15199.99
E	15099.99
F	14999.99
G	14899.99
H	14799.99
I	14699.99
J	14599.99
MAX	15589.85
MIN	14592.20

RUN 93C MACH=.27 TGAS=793 ENDWALL PRESSURE CONTOURS

CONTOUR PLOT OF PRESSURE

SCALE = 1.0000 PLOT TIME AND DATE = 10:47:50 80/212

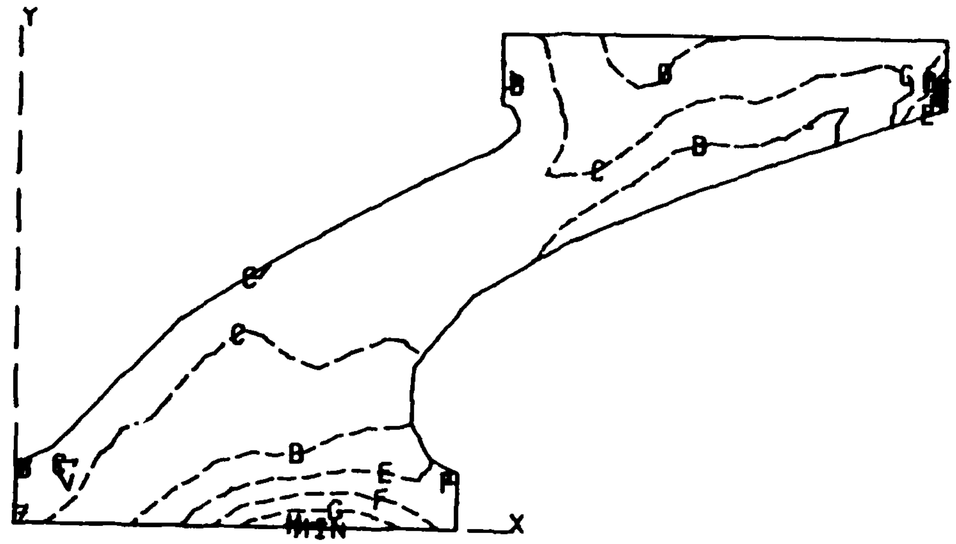


*** LEGEND ***

UNITS = TEMP

SYMBOL	CONTOUR
A	7.10000E 02
B	6.90000E 02
C	6.70000E 02
D	6.50000E 02
E	6.30000E 02
F	6.10000E 02
G	5.90000E 02
MAX	7.17676E 02
MIN	5.87429E 02

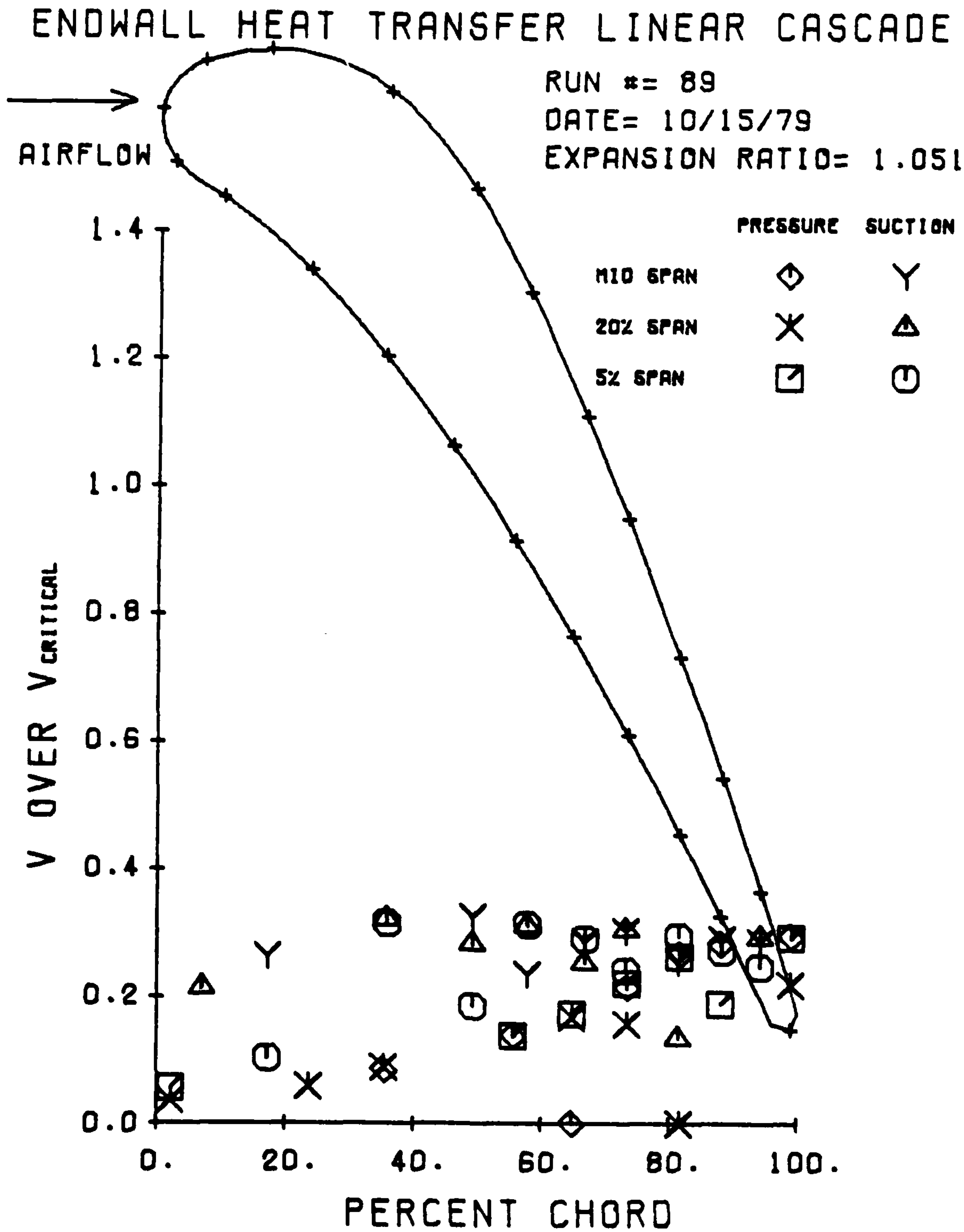
RUN 93C MACH .28 TGAS 811. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 9:38:31 79/303

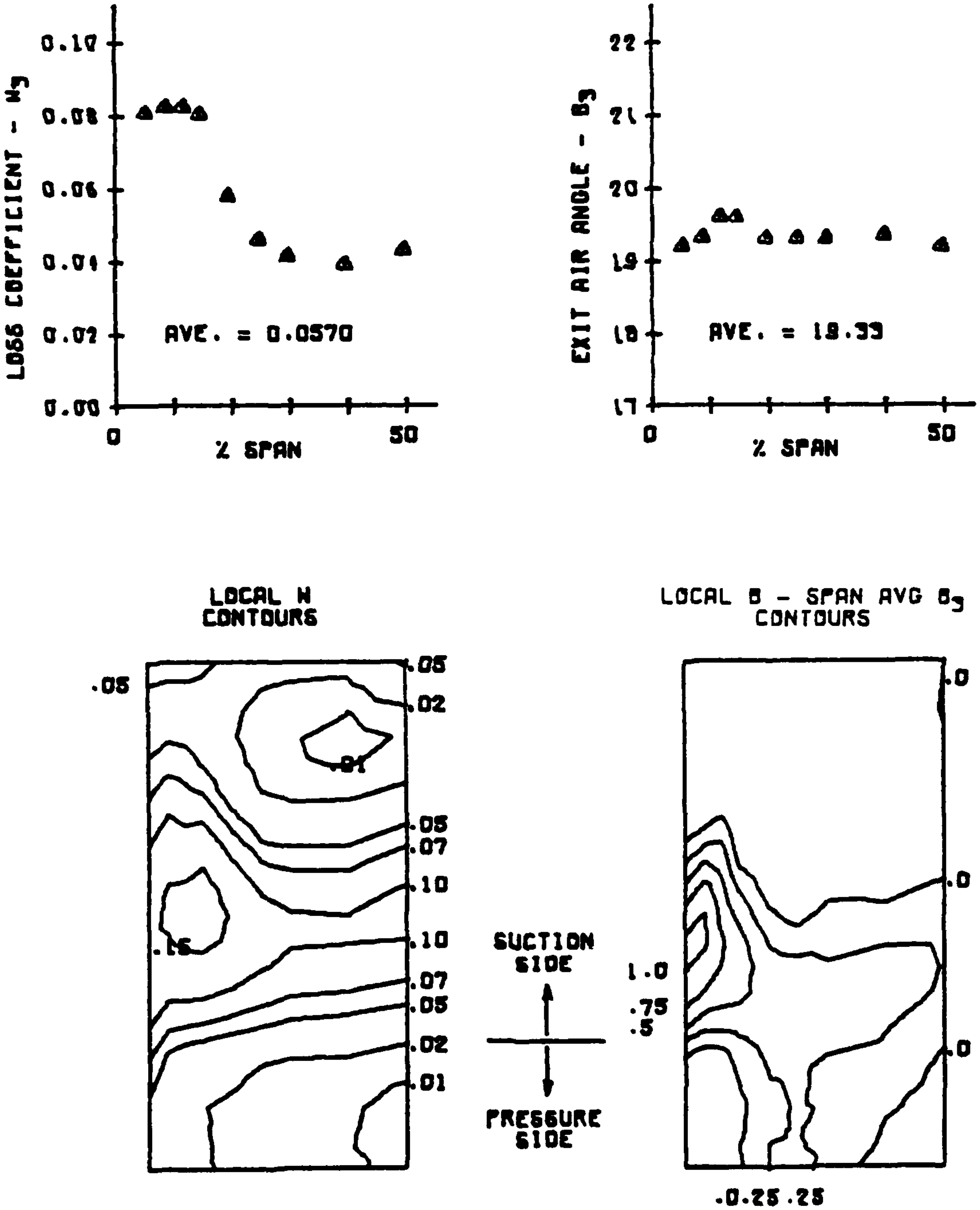


*** LEGEND ***
F
(E-03)

B	-2.00
C	-4.00
D	-6.00
E	-8.00
F	-10.00
G	-12.00
H	-14.00
MAX	-.21
MIN	-14.75

RUN 93C MACH .27 TGAS 793. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 8:33:09 80/050


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 89
DATE= 10/15/79
EXPANSION RATIO= 1.051
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.
20.
40.
60.
80.
100.
PERCENT CHORD

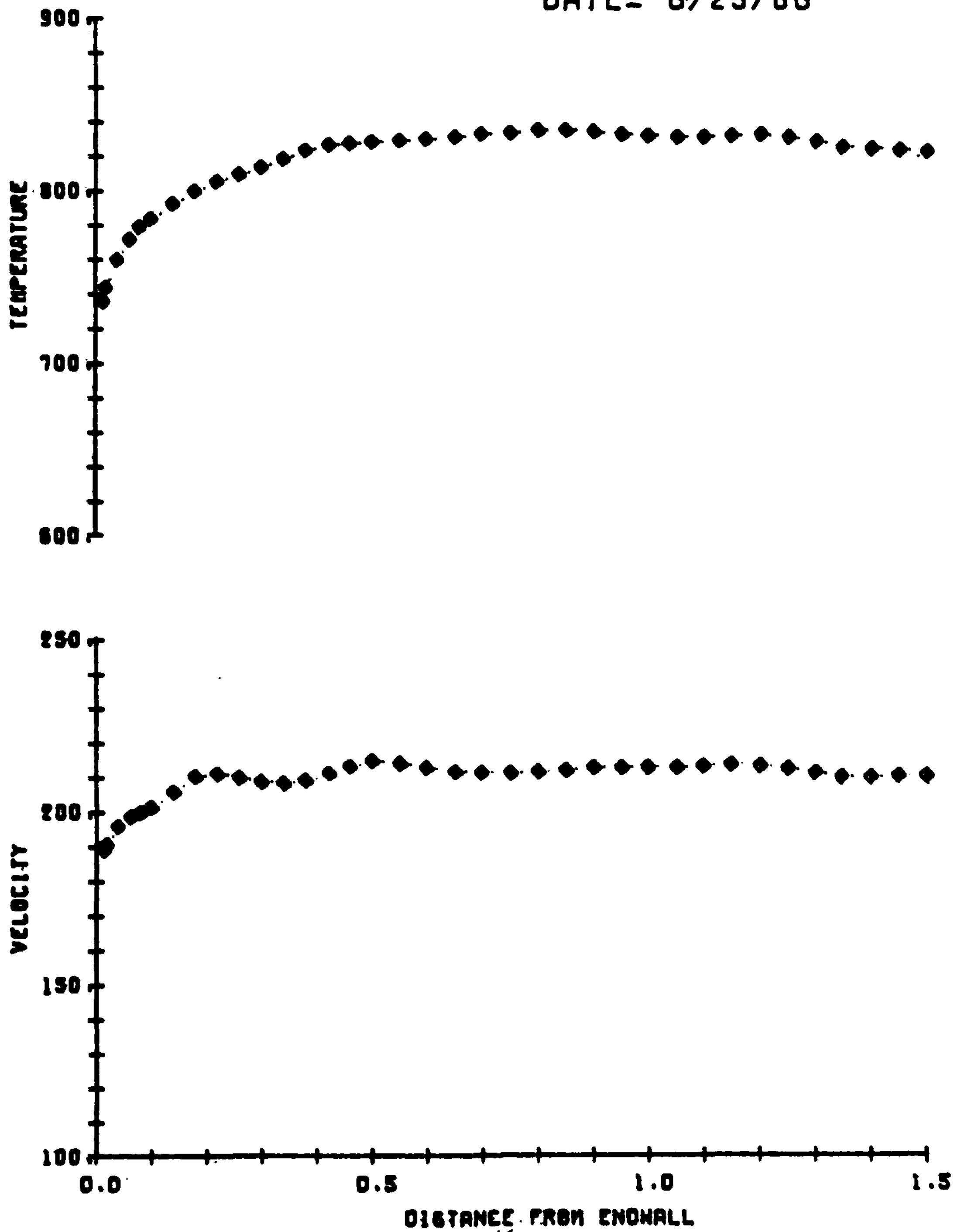


EXIT MACH NO. = 0.27 REYNOLDS NO. = 2.05 X 10^5

RUN 89 AERODYNAMIC EXIT DATA

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 176
DATE= 6/25/80



GMA 200 TURBINE VANE CASCADE

RUN # 91 DATE: 10/18/79 TIME: 11:52:47

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
51.66	50.27	1276.97	.200	.217	.502

IDEAL EXIT CONDITIONS

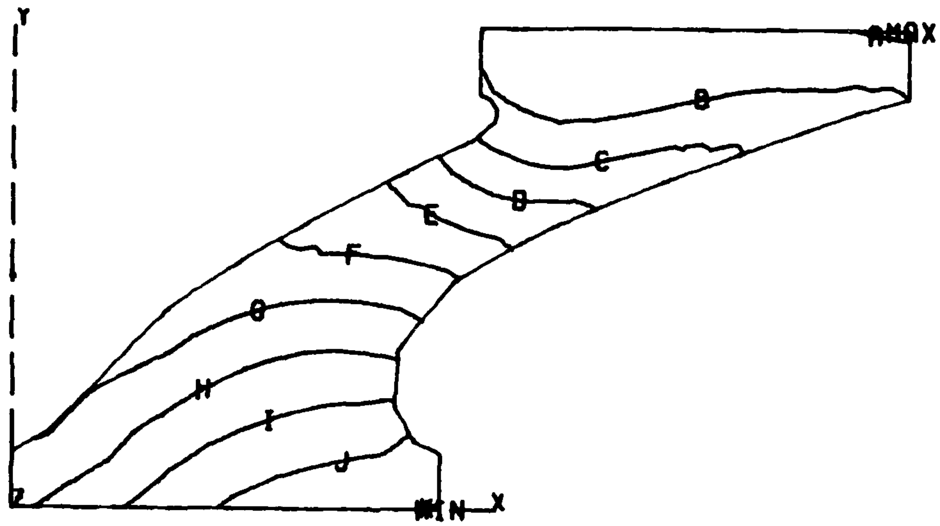
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
51.66	24.52	1276.97	1.100	1.083	1.675

CASCADE OPERATING CONDITION

EXPANSION RATIO= 2.107 STATIC PRESSURE RATIO= .488

*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
49.9	1.827	49.58	1215.	1.045	17.81	.0784	.0520
46.1	1.829	49.67	1199.	1.049	17.67	.0750	.0496
29.9	1.819	49.89	1217.	1.052	17.63	.0664	.0439
25.1	1.808	49.83	1216.	1.050	17.53	.0688	.0455
20.8	1.818	49.90	1208.	1.054	17.57	.0661	.0436
15.5	1.814	49.64	1206.	1.051	17.60	.0759	.0502
12.4	1.839	49.26	1169.	1.041	17.70	.0902	.0601
9.2	1.844	49.08	1177.	1.035	17.85	.0974	.0651
6.7	1.826	49.09	1196.	1.036	17.84	.0972	.0649
AVERAGE	1.824	49.60	1203.	1.047	17.68	.0777	.0516

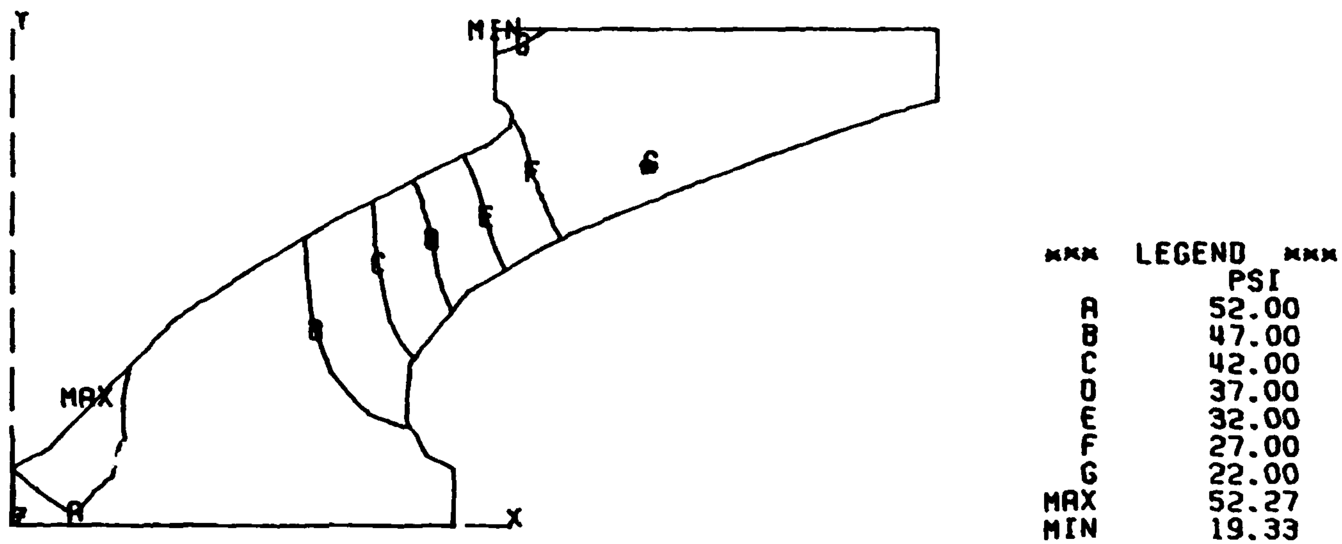


*** LEGEND ***

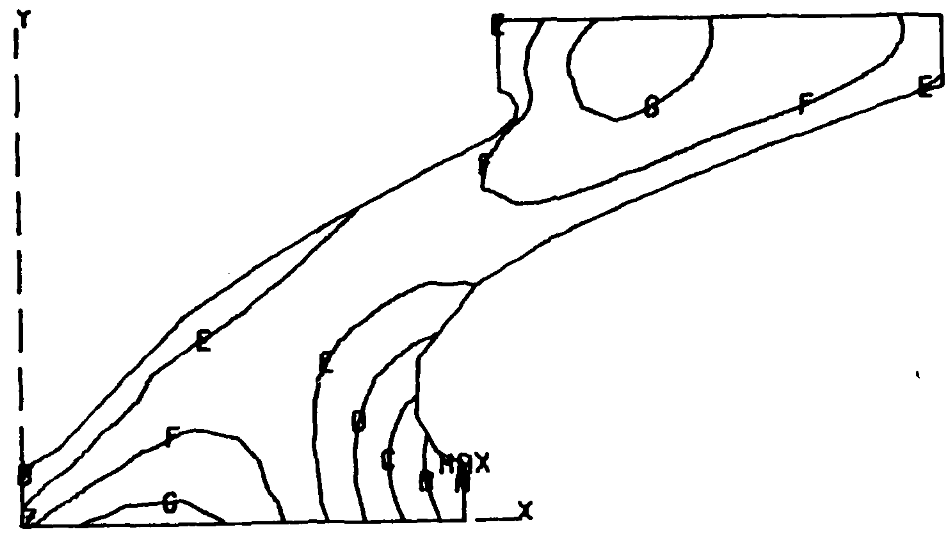
UNITS = TEMP

SYMBOL	CONTOUR
A	6.30000E 02
B	6.20000E 02
C	6.10000E 02
D	6.00000E 02
E	5.90000E 02
F	5.80000E 02
G	5.70000E 02
H	5.60000E 02
I	5.50000E 02
J	5.40000E 02
K	5.30000E 02
MAX	6.31622E 02
MIN	5.29113E 02

RUN 91 MACH 1.1 TGAS 800. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 18:17:45 79/291



RUN 91 MACH 1.1 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:23:28 80/158

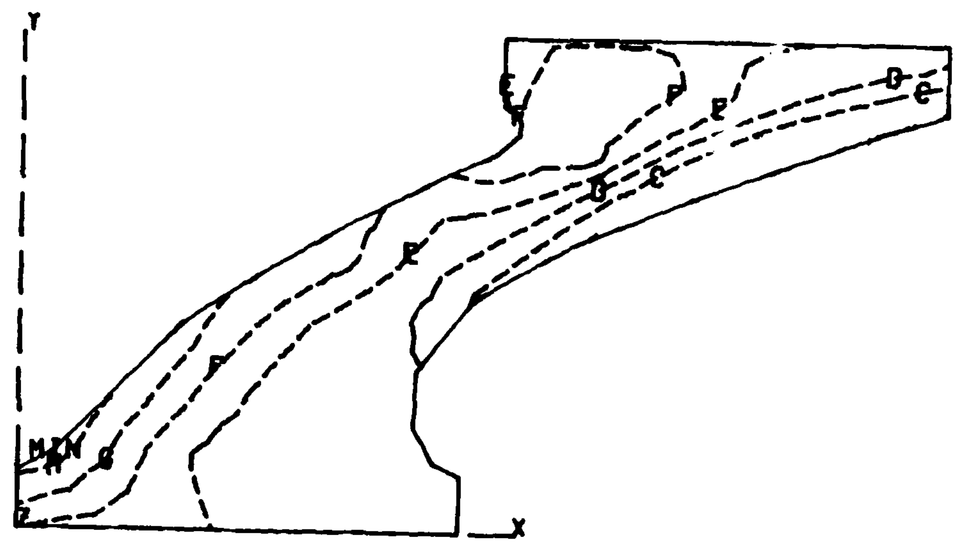


*** LEGEND ***

UNITS = TEMP

SYMBOL	CONTOUR
A	7.02000E 02
B	6.95000E 02
C	6.88000E 02
D	6.81000E 02
E	6.74000E 02
F	6.67000E 02
G	6.60000E 02
MAX	7.02676E 02
MIN	6.56242E 02

RUN 91 MACH 1.1 TGAS 800. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 8:48:03 79/305

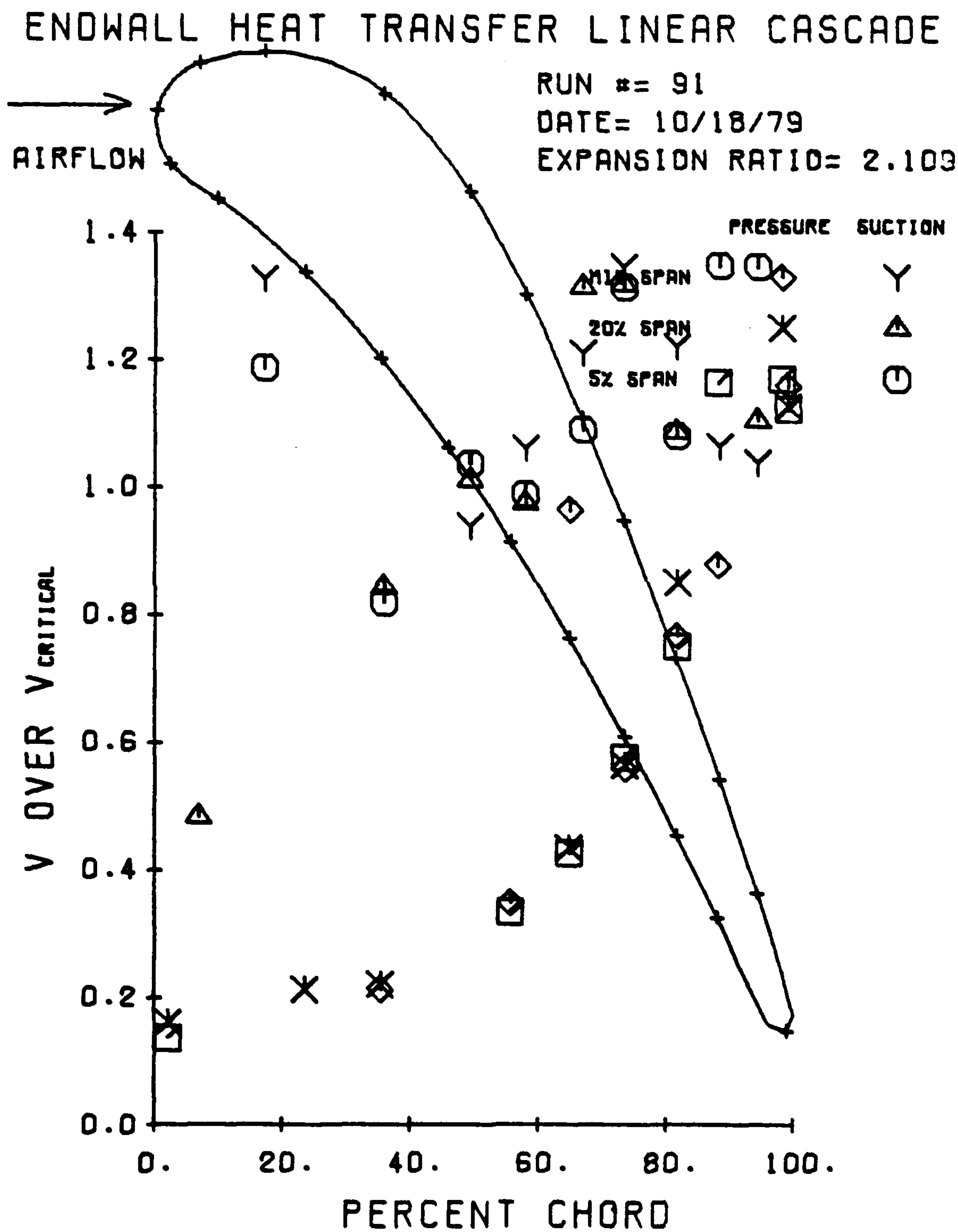


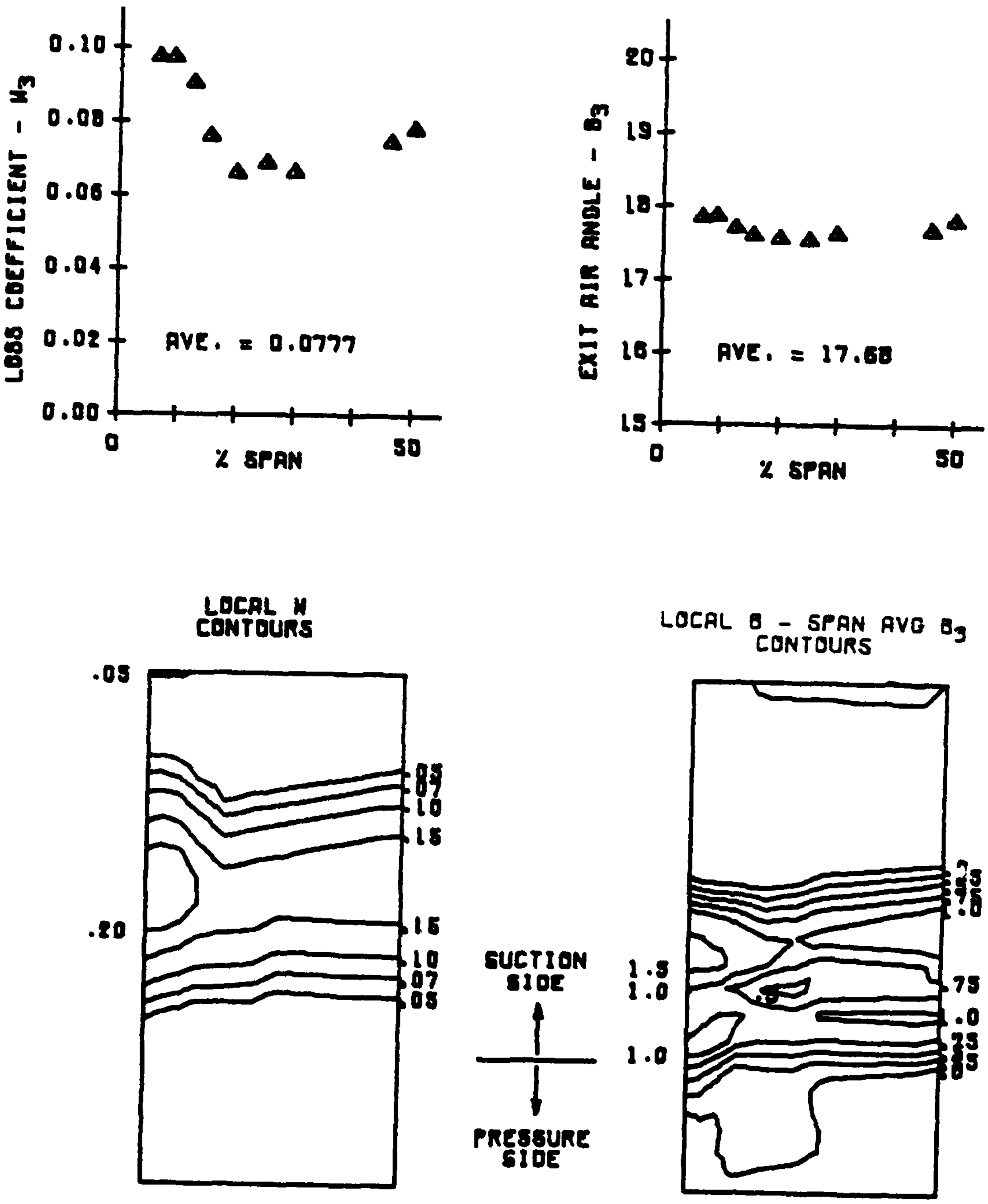
*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
C	-1.00000E-03
D	-2.00000E-03
E	-3.00000E-03
F	-4.00000E-03
G	-5.00000E-03
H	-5.99999E-03

MIN -6.49403E-03

RUN 91 MACH 1.1 TGAS 800. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 18:18:05 79/291

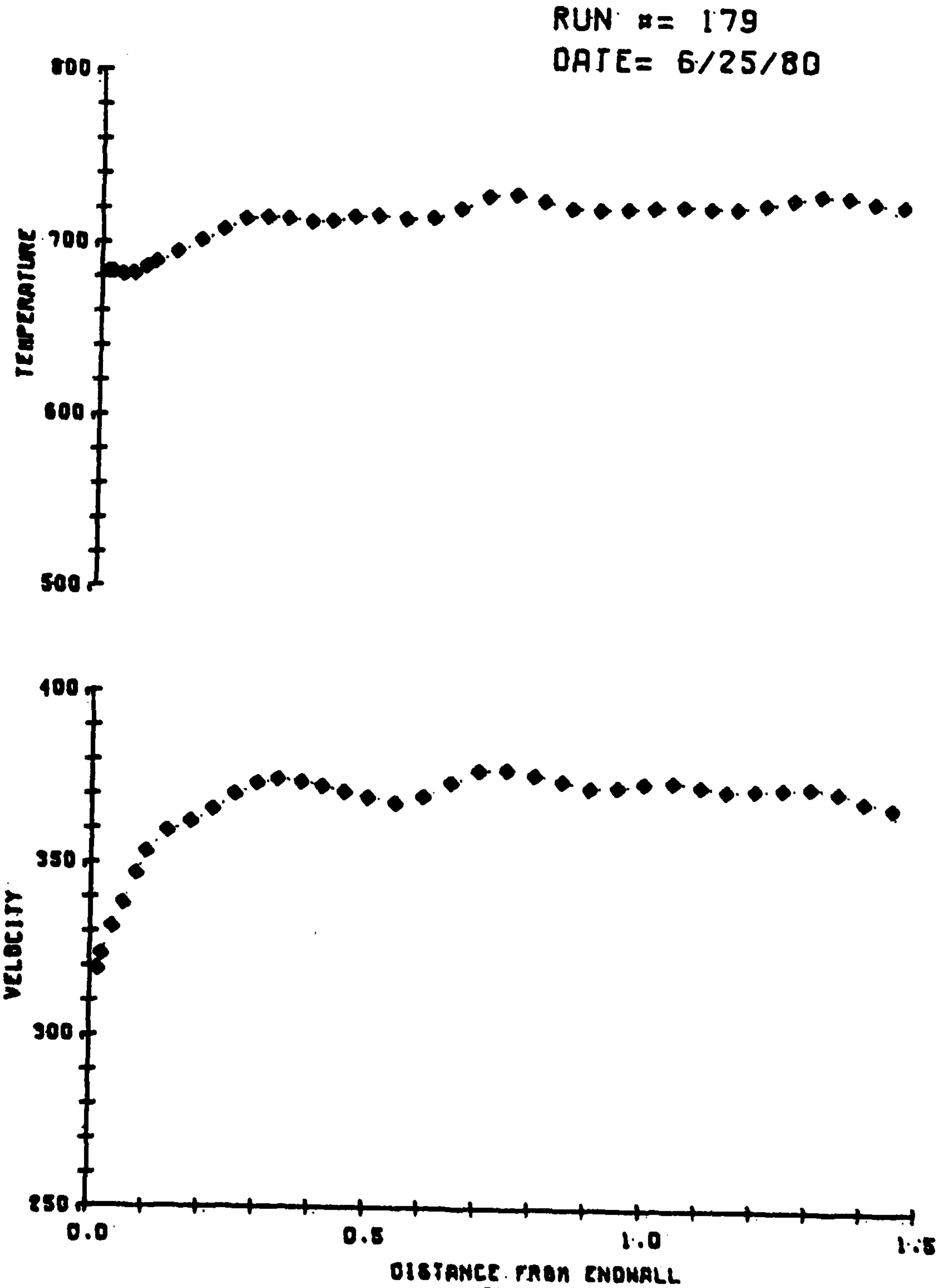

ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 91
DATE= 10/18/79
EXPANSION RATIO= 2.103
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V OVER V CRITICAL
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 1.10 REYNOLDS NO. = 1.67 X 10^6

RUN 91 AERODYNAMIC EXIT DATA

ENDWALL HEAT TRANSFER LINEAR CASCADE



GMA 200 TURBINE VANE CASCADE

RUN # 94 DATE: 10/24/79 TIME: 8: 6:44

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
15.49	15.37	1391.52	.106	.114	.073

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.17295	8210517.	929.09

CP - BTU/LBM/F
.260

MASS FLOW RATE

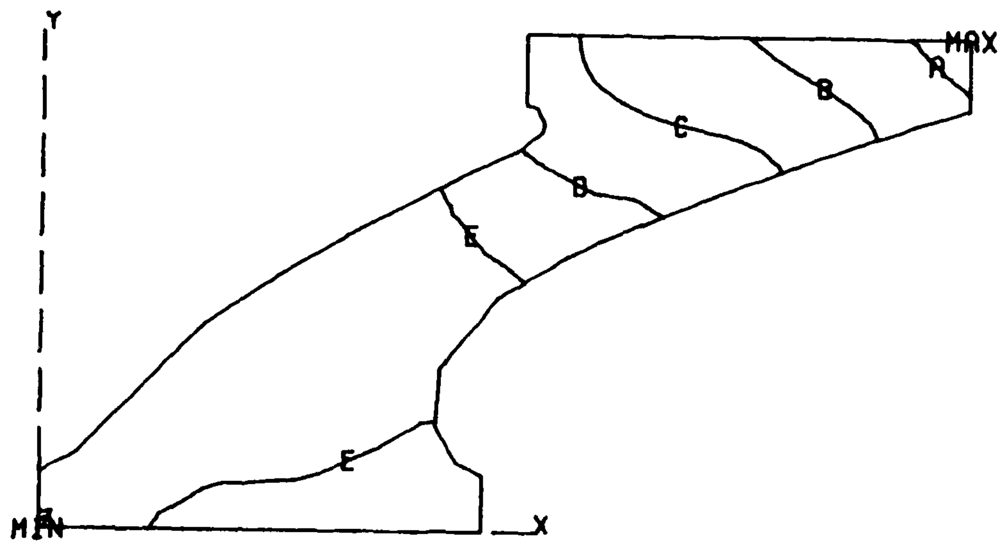
ORIFICE .36 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
15.49	14.68	1391.52	.283	.305	.189

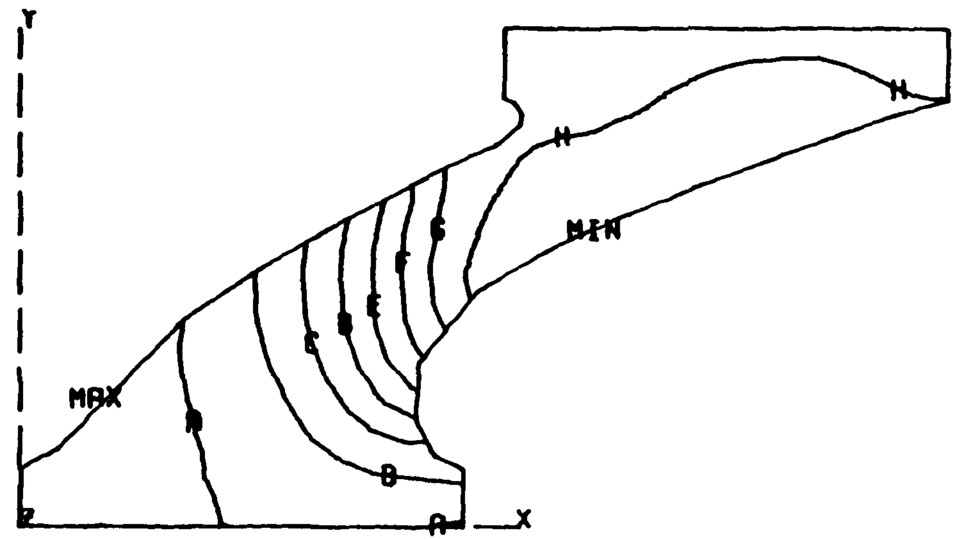
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.055 STATIC PRESSURE RATIO= .955



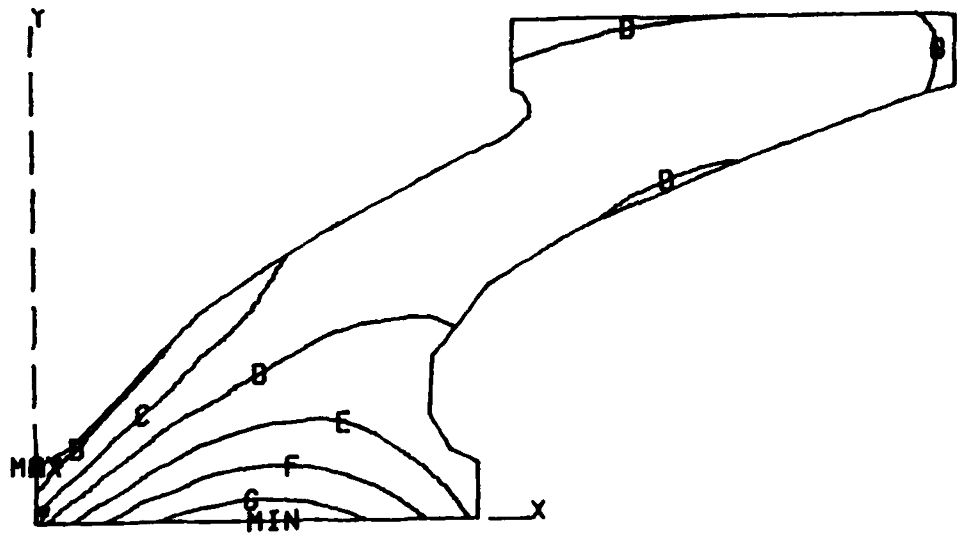
*** LEGEND ***	F
A	550.00
B	530.00
C	510.00
D	490.00
E	470.00
MAX	559.84
MIN	450.88

RUN 94 MACH .3 TGAS 1000. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 18:31:25 80/045



***	LEGEND ***
	PSI
	(E-03)
A	15399.99
B	15299.99
C	15199.99
D	15099.99
E	14999.99
F	14899.99
G	14799.99
H	14699.99
MAX	15448.65
MIN	14603.29

RUN 94 MACH .3 TGAS 1000 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:39:27 80/158

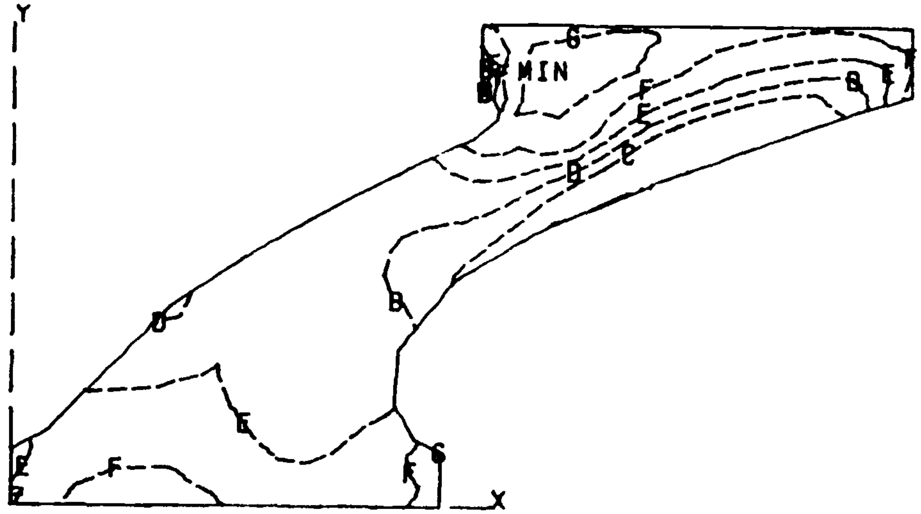


*** LEGEND ***

UNITS = TEMP

SYMBOL	CONTOUR
A	9.90000E 02
B	9.60000E 02
C	9.30000E 02
D	9.00000E 02
E	8.70000E 02
F	8.40000E 02
G	8.10000E 02
MAX	9.92881E 02
MIN	7.89215E 02

RUN 94 MACH .3 TGAS 1000. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:07:28 79/304



*** LEGEND ***
F
(E-03)

C	-2.00
D	-4.00
E	-6.00
F	-8.00
G	-10.00
MIN	-11.32

RUN 94 MACH .3 TGAS 1000. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 18:31:48 80/045

GMA 200 TURBINE VANE CASCADE

RUN # 98 DATE: 10/30/79 TIME: 4:40:21

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
55.58	54.38	1477.25	.187	.202	.428

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.57868	14975222.	1008.54

CP - BTU/LBM/F
.263

MASS FLOW RATE

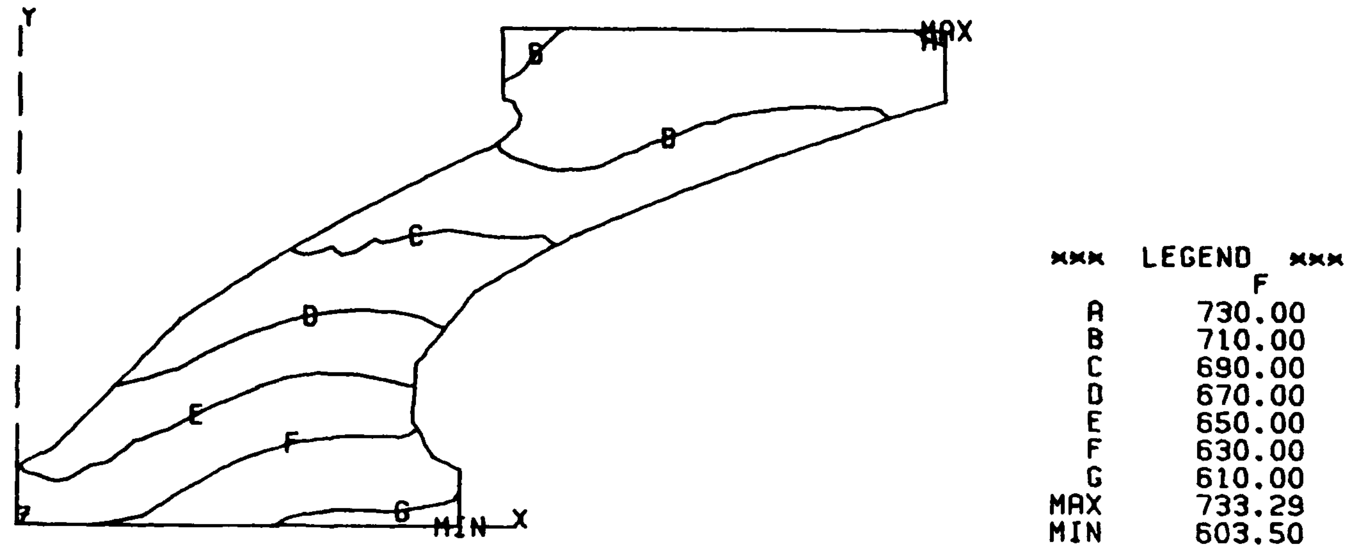
ORIFICE 9.31 CASCADE

IDEAL EXIT CONDITIONS

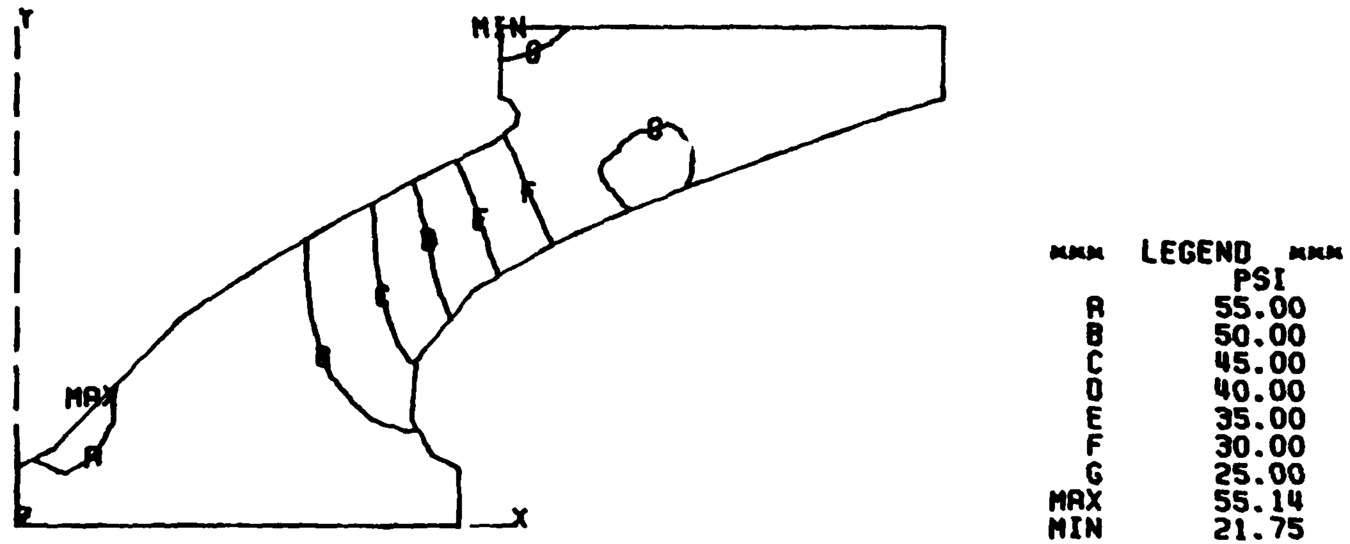
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
55.68	26.85	1477.25	1.090	1.075	1.516

CASCADE OPERATING CONDITION

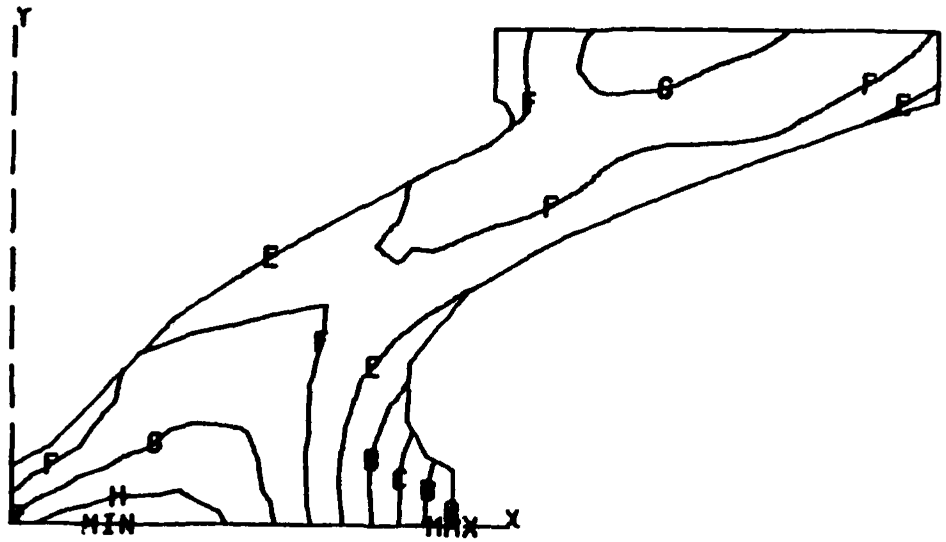
EXPANSION RATIO= 2.074 STATIC PRESSURE RATIO= .494



RUN 98 MACH 1.1 TGAS 1000. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 9:38:48 80/050



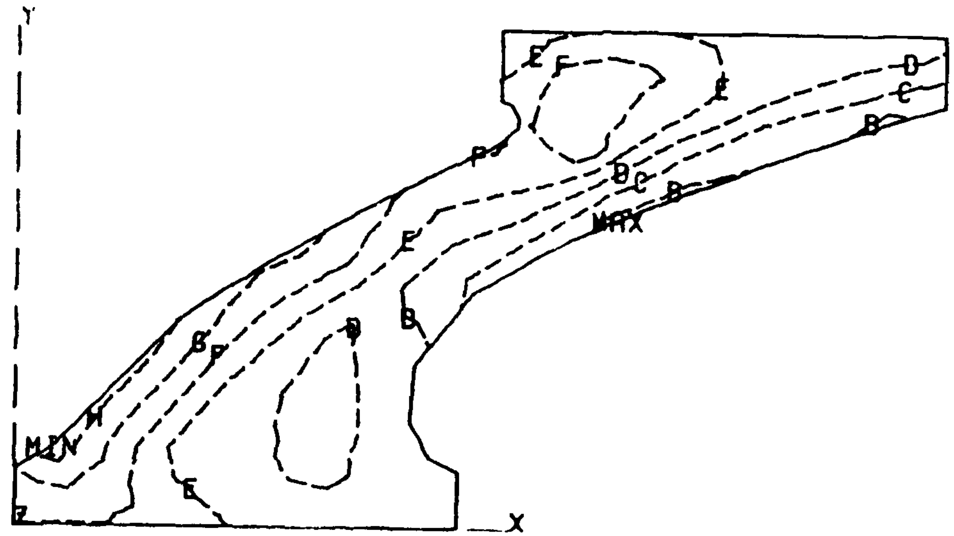
RUN 98 MACH 1.1 TGAS 1000 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 13:34:20 80/158



*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	8.80000E 02
B	8.70000E 02
C	8.60000E 02
D	8.50000E 02
E	8.40000E 02
F	8.30000E 02
G	8.20000E 02
H	8.10000E 02
MAX	8.81845E 02
MIN	8.00573E 02

RUN 98 MACH 1.1 TGAS 1000. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:50:37 79/304



*** LEGEND ***
F
(E-06)

B	-1000.00
C	-2000.00
D	-3000.00
E	-4000.00
F	-5000.00
G	-6000.00
H	-6999.99
MAX	-655.42
MIN	-7660.68

RUN 98 MACH 1.1 TGAS 1000. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 9:39:21 80/050

GMA 200 TURBINE VANE CASCADE

RUN # 99 DATE: 10/30/79 TIME: 7:34: 0

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
21.75	21.25	1442.00	.186	.201	.171

IDEAL EXIT CONDITIONS

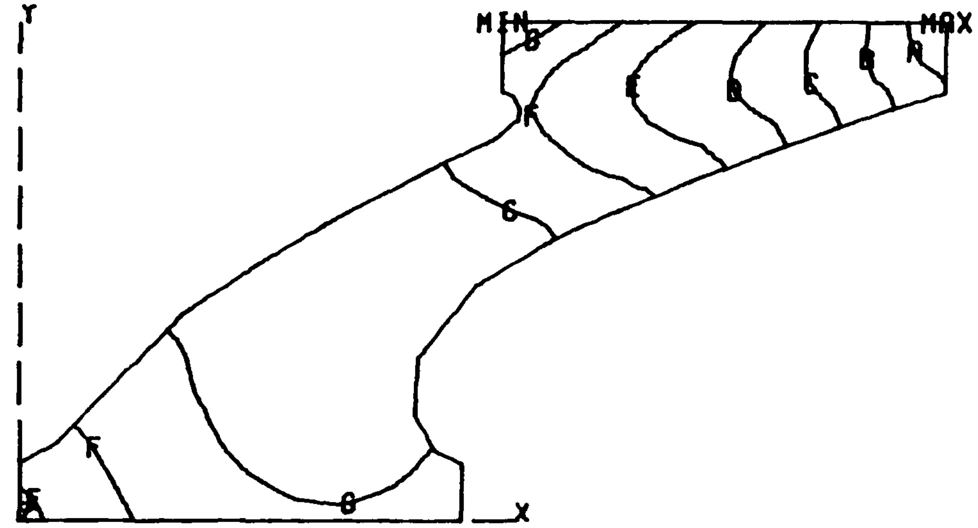
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
21.75	15.94	1442.00	.692	.721	.519

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.365 STATIC PRESSURE RATIO= .750

*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.1	.672	21.53	1392.	.677	18.01	.0377	.0314
40.1	.670	21.54	1386.	.678	17.90	.0371	.0306
29.9	.661	21.54	1441.	.679	17.96	.0359	.0298
24.9	.666	21.53	1416.	.677	17.98	.0373	.0311
20.0	.661	21.47	1431.	.672	18.05	.0484	.0403
14.9	.683	21.34	1359.	.664	18.45	.0715	.0599
11.9	.691	21.29	1348.	.660	18.73	.0810	.0679
8.9	.690	21.27	1351.	.658	18.73	.0830	.0704
7.5	.688	21.28	1336.	.658	18.56	.0827	.0694
AVERAGE	.674	21.44	1388.	.671	18.19	.0534	.0446

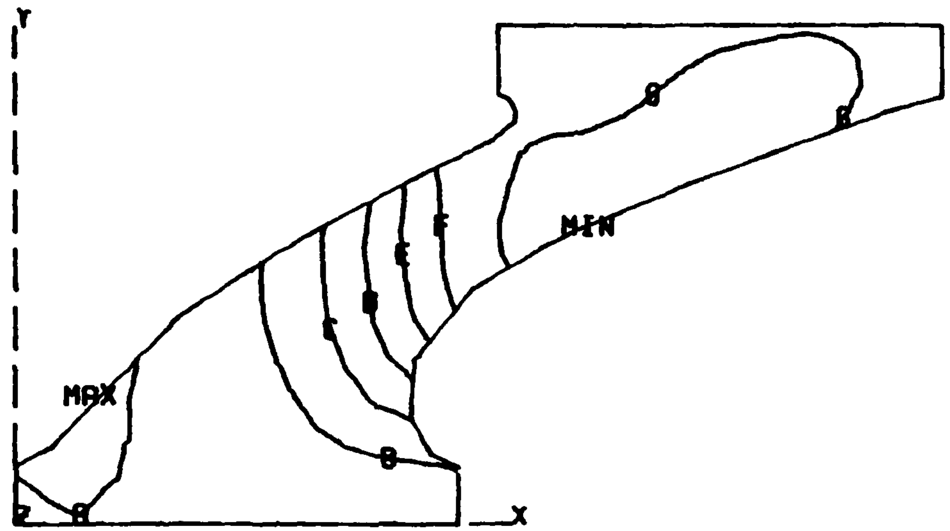


*** LEGEND ***

UNITS = TEMP

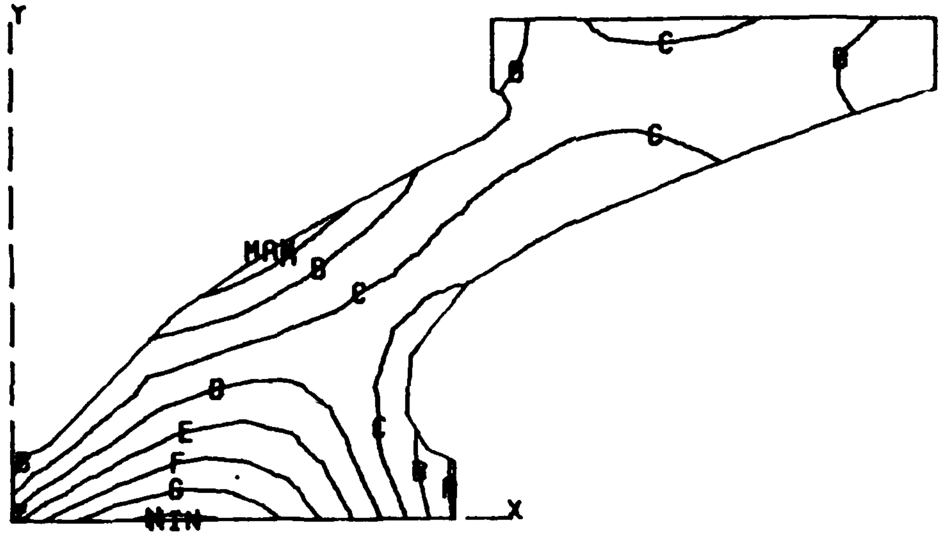
SYMBOL	CONTOUR
A	5.80000E 02
B	5.70000E 02
C	5.60000E 02
D	5.50000E 02
E	5.40000E 02
F	5.30000E 02
G	5.20000E 02
MAX	5.88439E 02
MIN	5.11049E 02

RUN 99 MACH .7 TGAS 1000. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 9:33:54 79/305



*** LEGEND ***	PSI (E-03)
A	21299.98
B	20399.98
C	19499.97
D	18599.96
E	17699.95
F	16799.94
G	15899.94
MAX	21398.39
MIN	15340.86

RUN 99 MACH .7 TGAS 1000 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 13:50:17 80/158



*** LEGEND ***

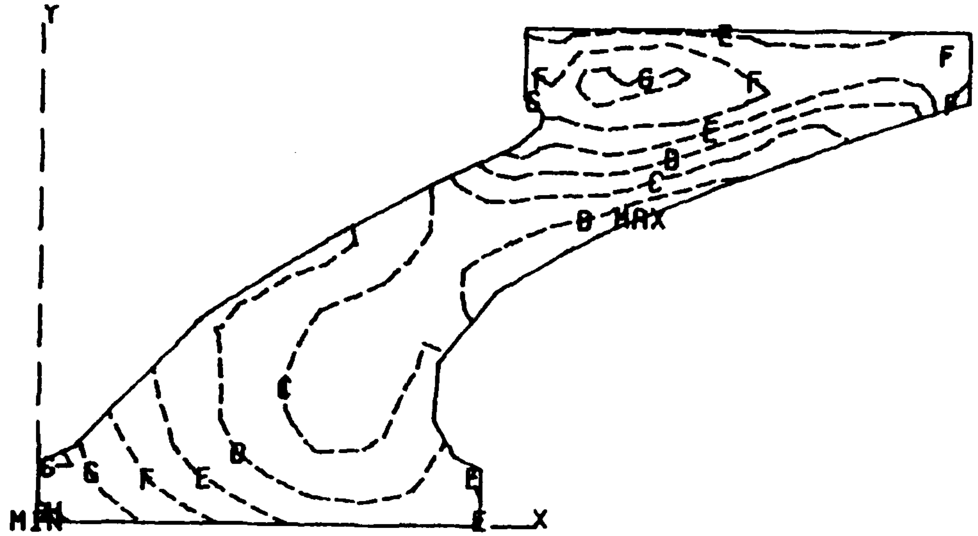
UNITS = TEMP

SYMBOL	CONTOUR
A	8.50000E 02
B	8.40000E 02
C	8.30000E 02
D	8.20000E 02
E	8.10000E 02
F	8.00000E 02
G	7.90000E 02
H	7.80000E 02
MAX	8.55605E 02
MIN	7.77689E 02

RUN 99 MACH .7 TGAS 1000. ADIABATIC ENDWALL

CONTOUR PLOT OF TEMPERATURE

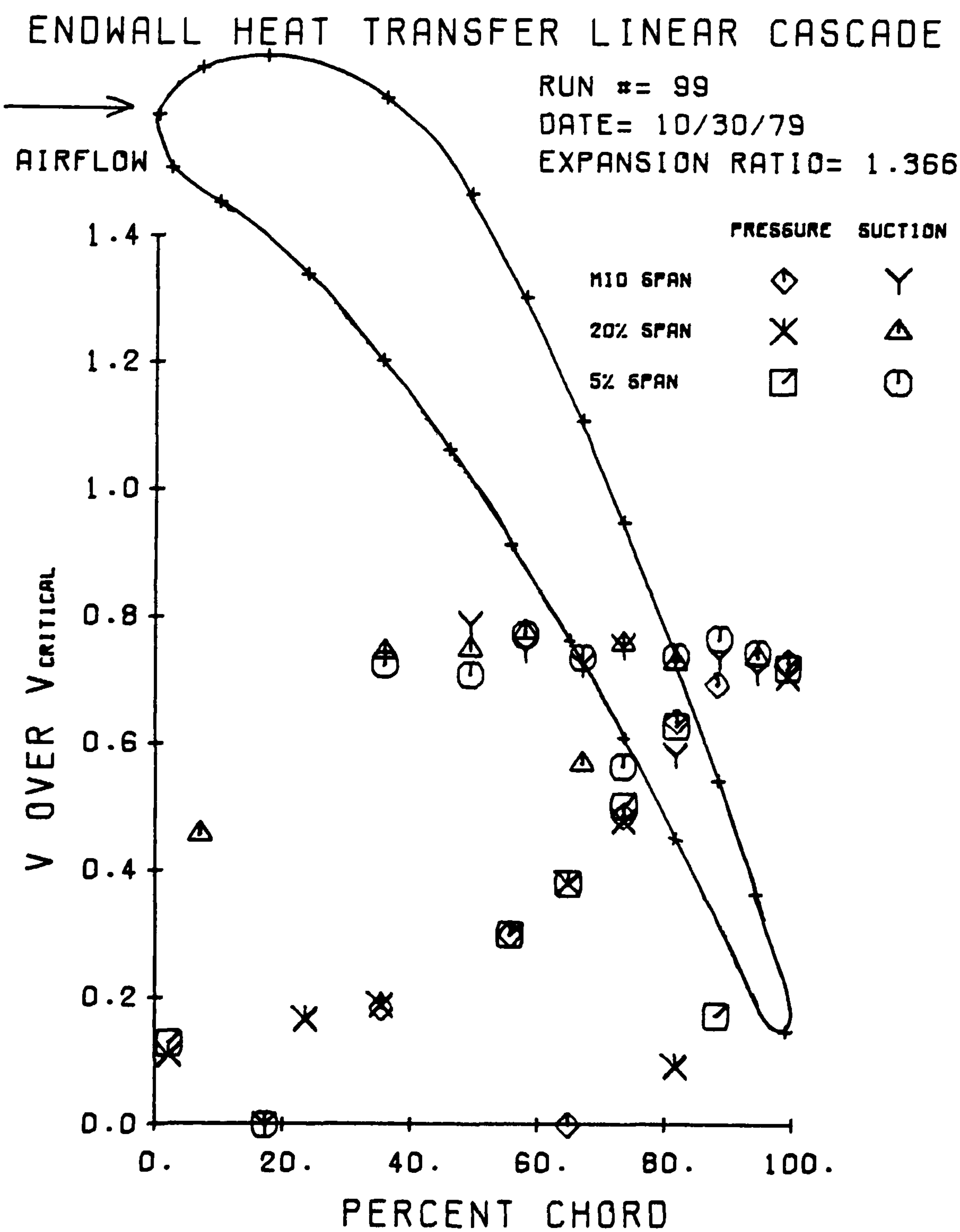
SCALE = 1.0000 PLOT TIME AND DATE = 16:04:22 79/304



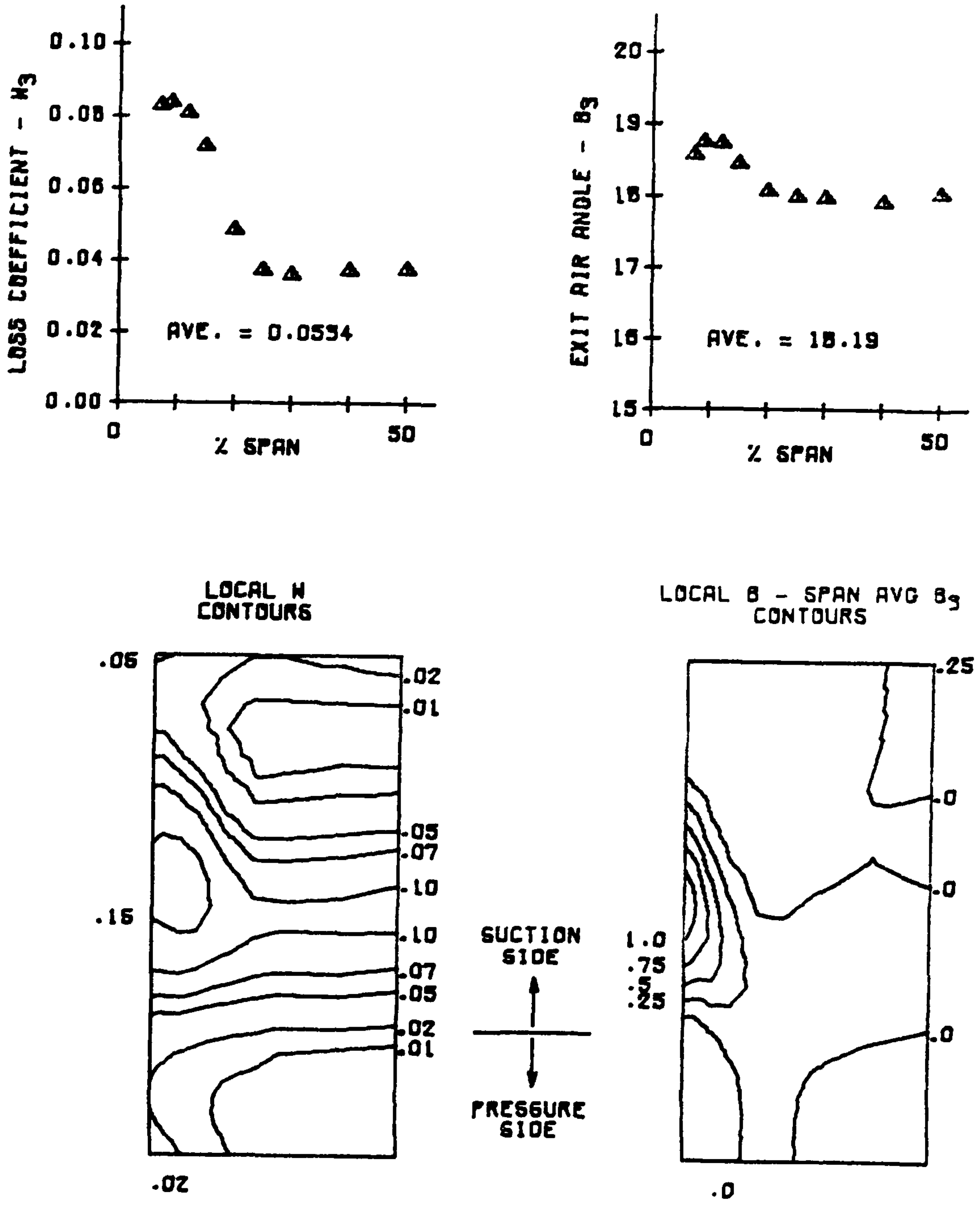
*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	-1.90000E-03
B	-2.60000E-03
C	-3.30000E-03
D	-4.00000E-03
E	-4.69999E-03
F	-5.39999E-03
G	-6.09999E-03
H	-6.79998E-03
MAX	-1.92371E-03
MIN	-7.13911E-03

RUN 99 MACH .7 TGAS 1000. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 9:34:36 79/305



ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 99
DATE= 10/30/79
EXPANSION RATIO= 1.366
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.69 REYNOLDS NO. = 5.19×10^5

RUN 99 AERODYNAMIC EXIT DATA

[illegible] TURBINE VANE CASCADE

RUN #[illegible] DATE: 11/[illegible]/79 TIME: 7:30: 5

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
21.49	20.86	672.99	.203	.222	.457

IDEAL EXIT CONDITIONS

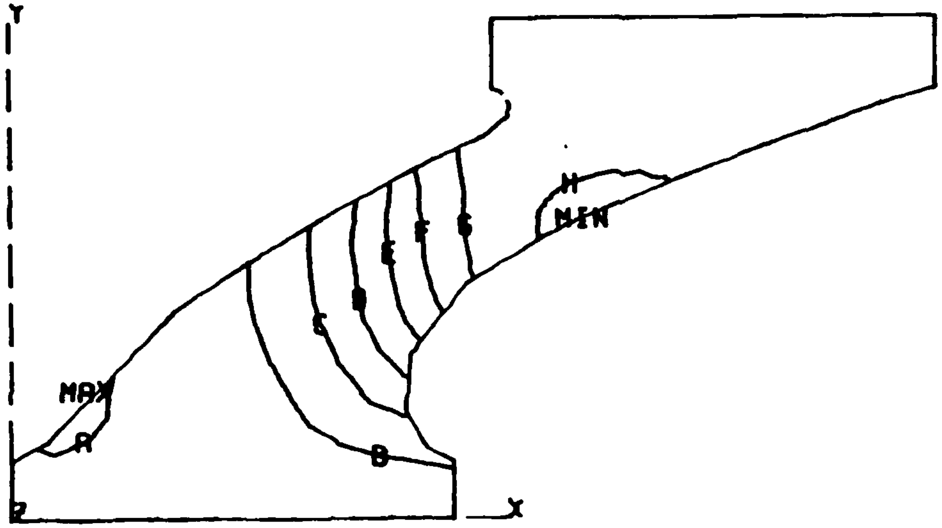
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
21.49	15.30	672.99	.714	.745	1.311

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.404 STATIC PRESSURE RATIO= .733

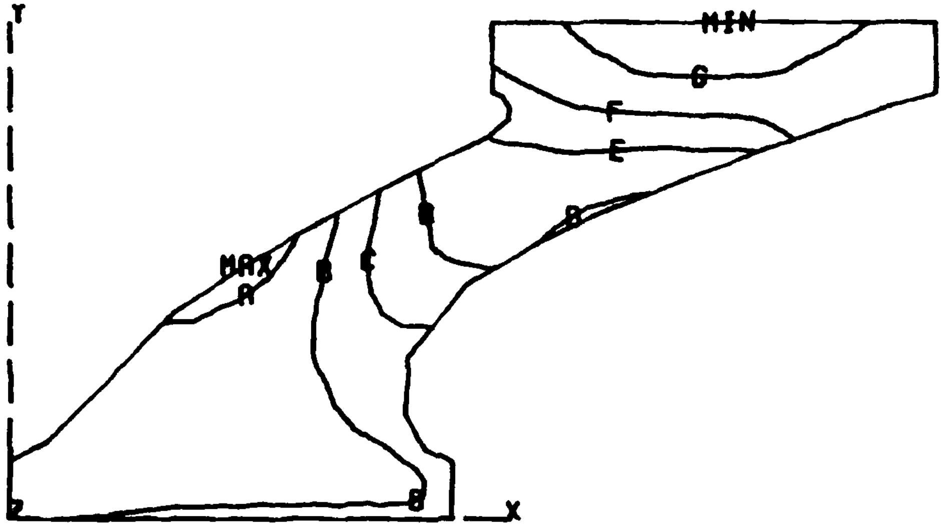
*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
49.8	.985	21.15	674.	.706	18.10	.0526	.0427
39.9	.985	21.14	673.	.707	18.11	.0545	.0442
29.9	.987	21.10	672.	.705	18.17	.0611	.0496
24.9	.986	21.02	673.	.701	18.27	.0729	.0594
19.9	.995	20.91	673.	.694	18.73	.0915	.0748
14.9	1.003	20.81	673.	.688	18.98	.1208	.0876
12.3	.995	20.81	672.	.688	18.75	.1268	.0875
11.2	.953	20.81	671.	.657	18.97	.1262	.0886
9.6	.962	20.82	671.	.657	19.15	.1267	.0692
AVERAGE	.990	20.90	673.	.695	18.3[illegible]	.0794	.0649



***	LEGEND	***
	PSI	
	(E-03)	
A	21299.98	
B	20399.98	
C	19499.97	
D	18599.96	
E	17699.95	
F	16799.94	
G	15899.94	
H	14999.94	
MAX	21352.20	
MIN	14772.29	

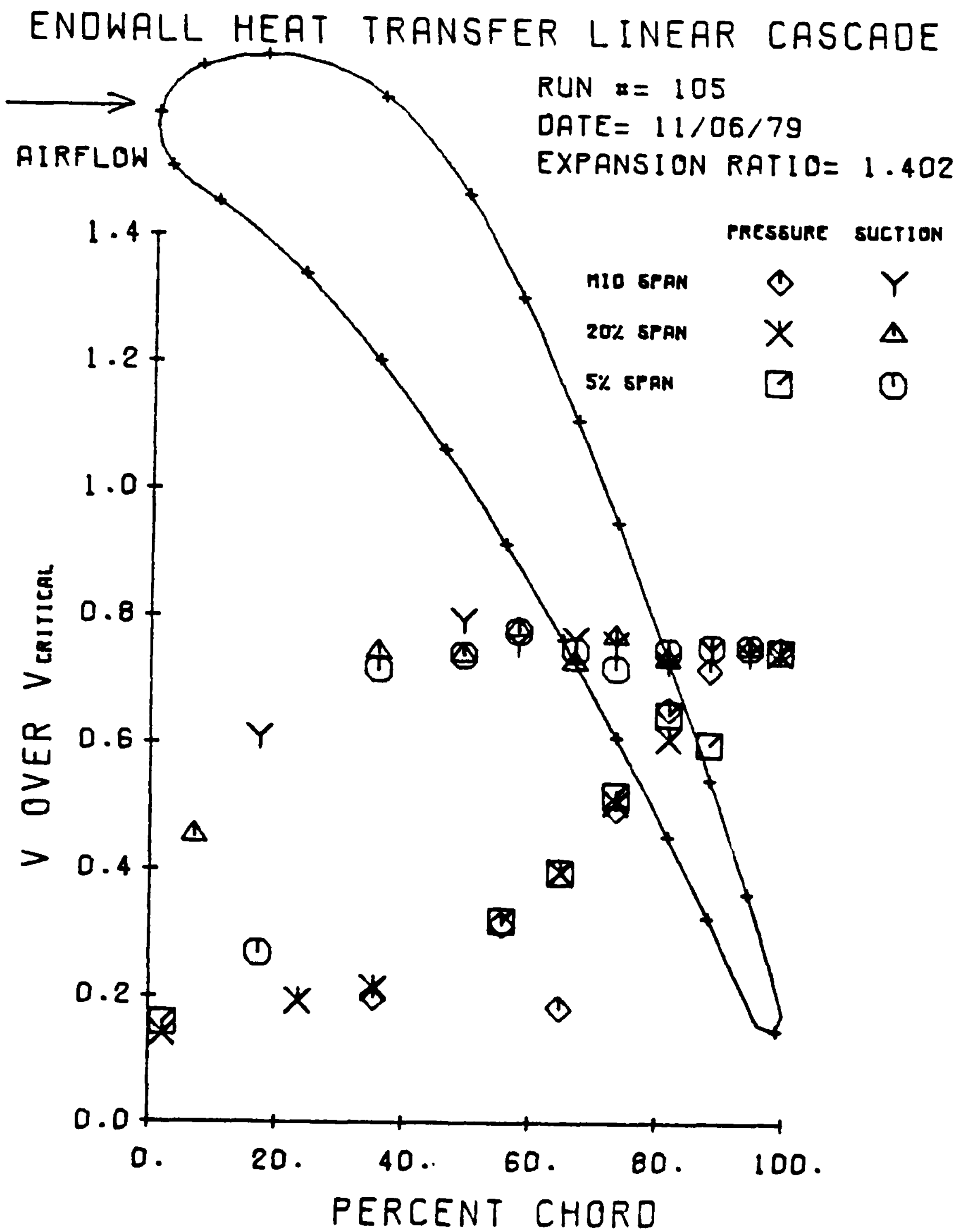
RUN 105 MACH .7 TGAS 200 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:34:43 80/158

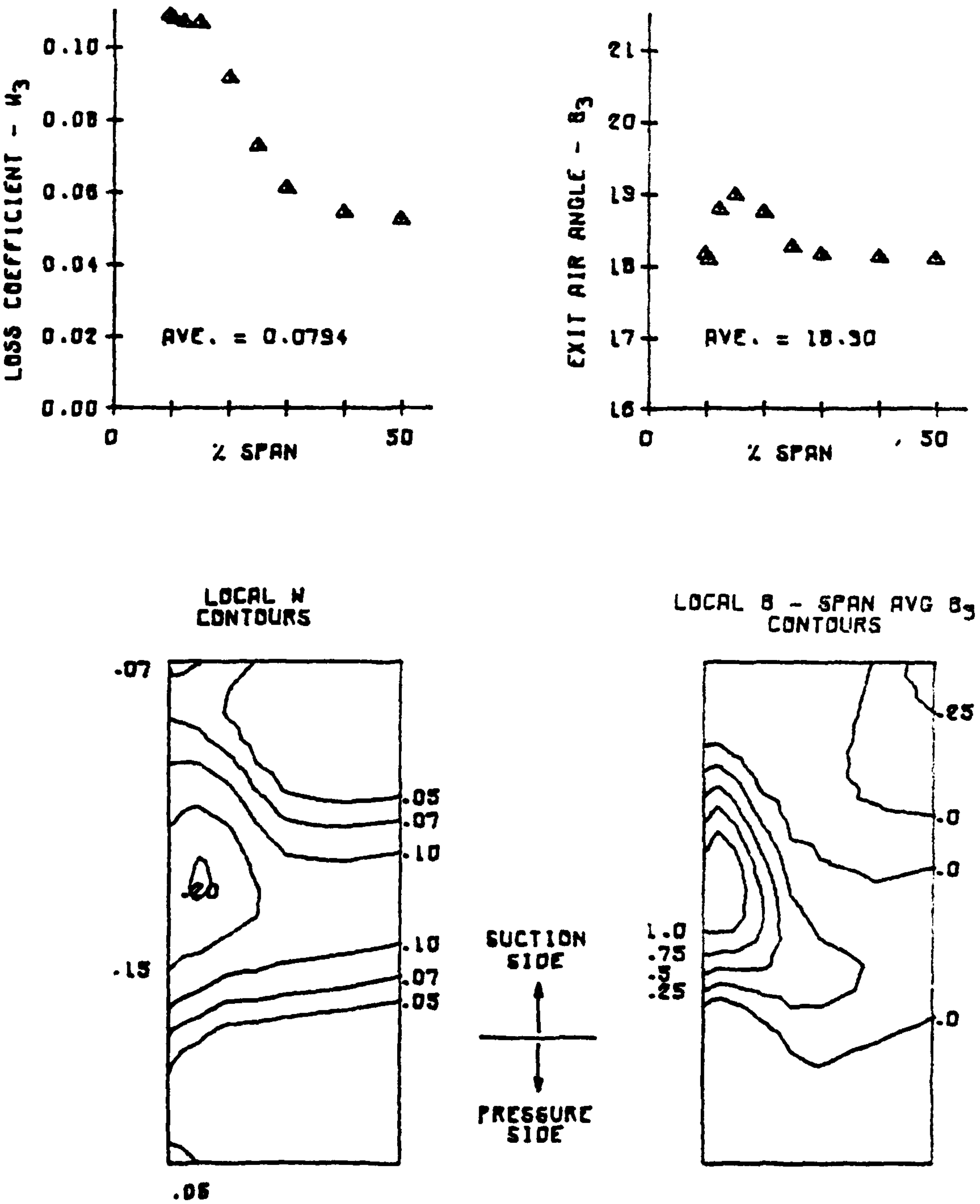


SYMBOL	CONTOUR
A	2.11000E 02
B	2.10000E 02
C	2.09000E 02
D	2.08000E 02
E	2.07000E 02
F	2.06000E 02
G	2.05000E 02
MAX	2.11360E 02
MIN	2.04255E 02

*** LEGEND ***
UNITS = TEMP

RUN 105 MACH .7 TGAS 200. ADIABATIC ENDWALL THICK B.L.
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 13:02:02 79/318


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 105
DATE= 11/06/79
EXPANSION RATIO= 1.402
AIRFLOW
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.71 REYNOLDS NO. = 1.31 X 10^6

RUN 105 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN #107 DATE: 11/07/79 TIME: 11:32:11

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
38.20	36.83	657.35	.229	.250	.937

IDEAL EXIT CONDITIONS

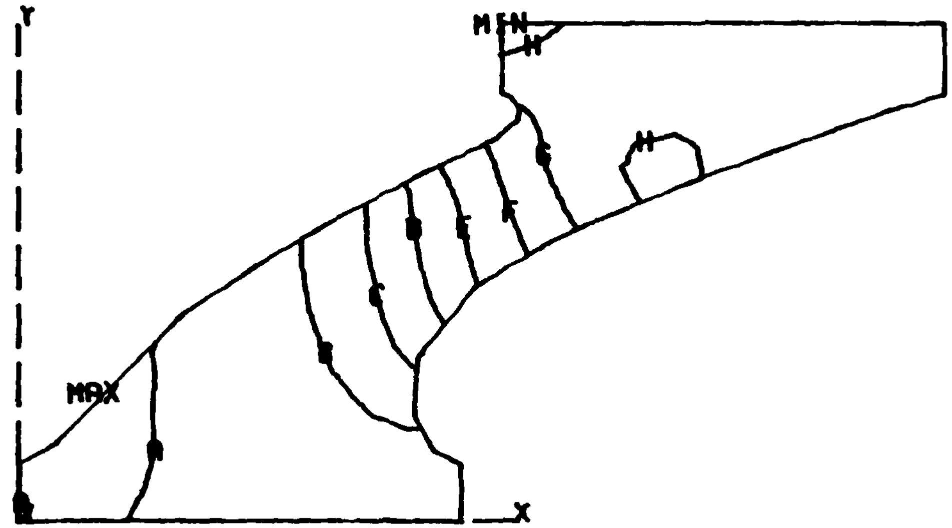
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
38.20	17.96	657.35	1.097	1.079	2.828

CASCADE OPERATING CONDITION

EXPANSION RATIO= 2.127 STATIC PRESSURE RATIO= .488

*** MIXED OUT CONDITION SUMMARY ***

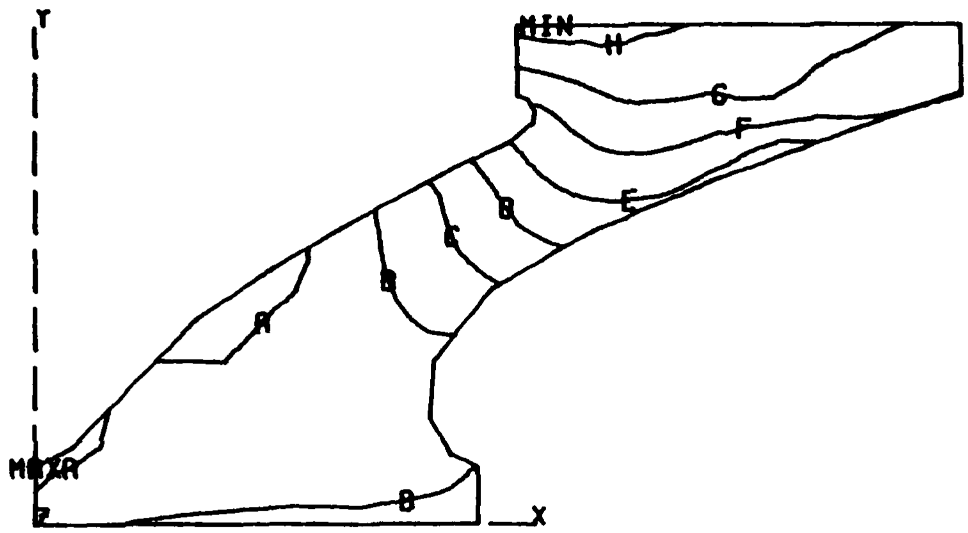
% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.1	1.871	36.66	664.	1.034	18.08	.0787	.0520
40.1	1.853	36.64	668.	1.031	17.95	.0800	.0529
30.1	1.836	36.61	668.	1.032	17.78	.0814	.0538
24.9	1.860	36.58	667.	1.032	18.03	.0830	.0549
20.0	1.876	36.32	668.	1.023	18.31	.0964	.0641
15.0	1.860	35.95	666.	1.010	18.39	.1157	.0777
12.5	1.860	35.89	666.	1.013	18.39	.1182	.0792
11.7	1.860	35.89	665.	1.015	18.39	.1182	.0791
11.4	1.861	35.87	666.	1.014	18.39	.1193	.0799
AVERAGE	1.858	36.34	666.	1.024	18.13	.0955	.0635



*** LEGEND ***

	PSI
A	37.00
B	34.00
C	31.00
D	28.00
E	25.00
F	22.00
G	19.00
H	16.00
MAX	37.33
MIN	13.53

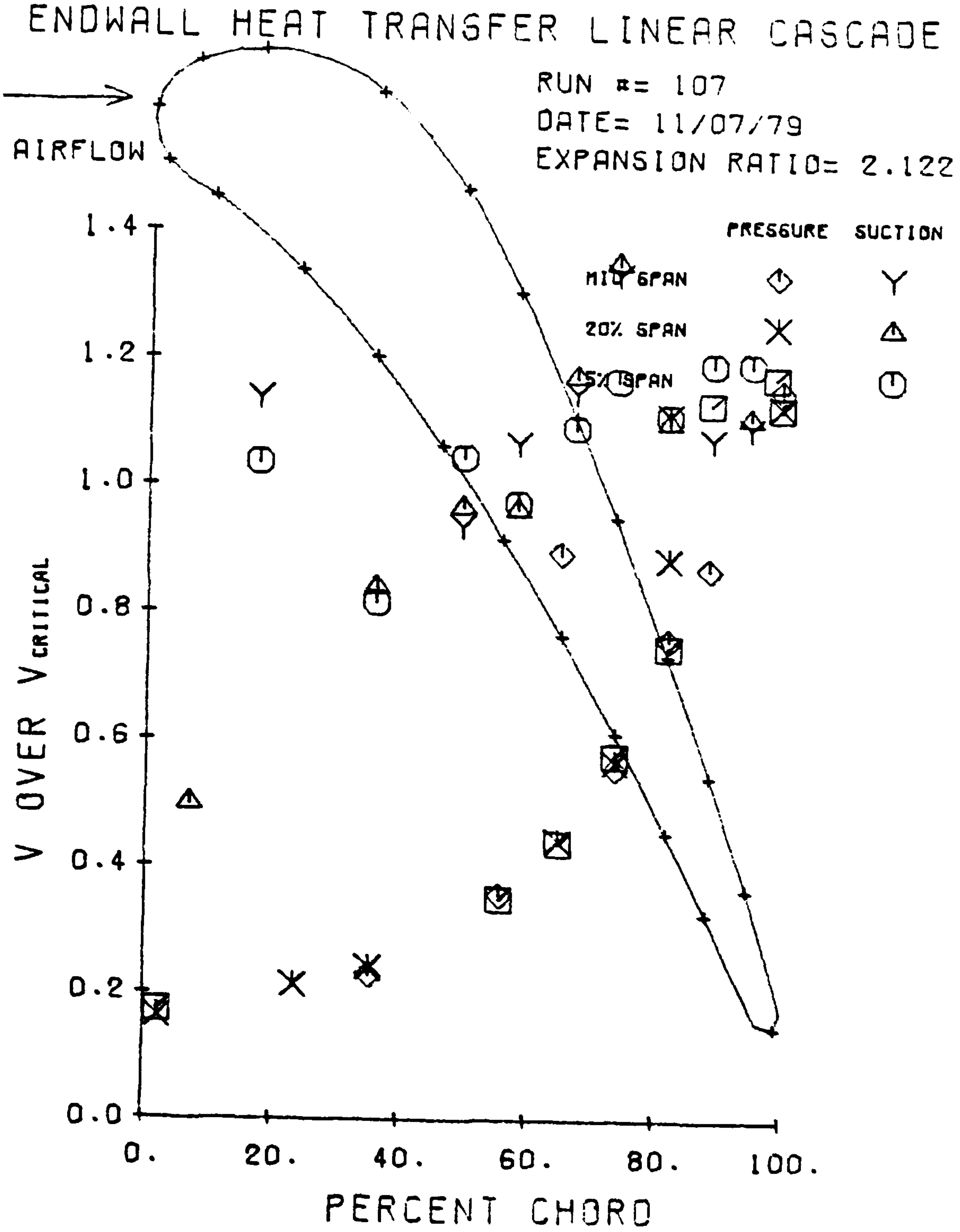
RUN 107 MACH 1.1 TGAS 200 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:23:39 80/158



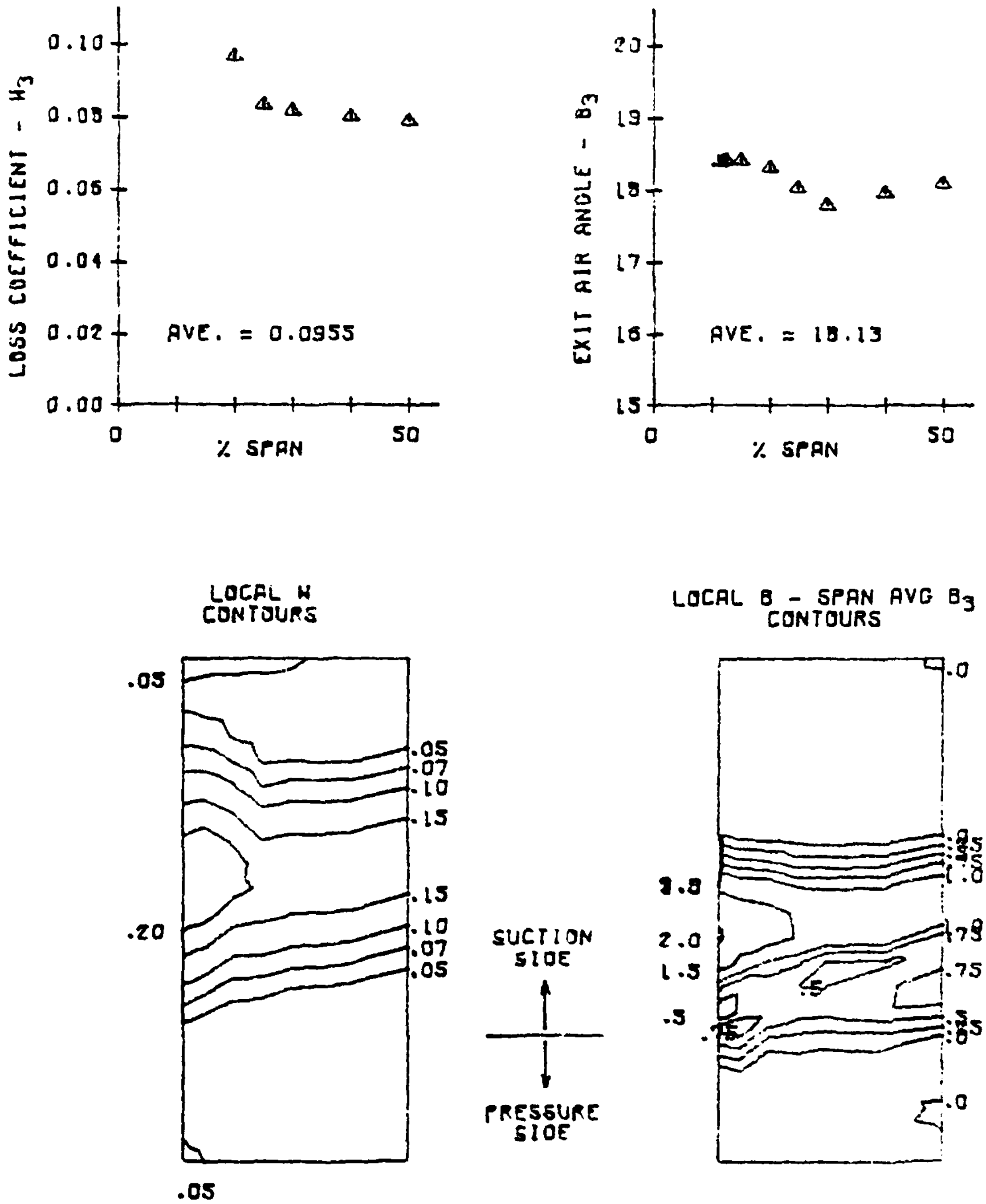
*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	2.01000E 02
B	1.99000E 02
C	1.97000E 02
D	1.95000E 02
E	1.93000E 02
F	1.91000E 02
G	1.89000E 02
H	1.87000E 02
MAX	2.01384E 02
MIN	1.86124E 02

RUN 107 MACH 1.1 TGAS 200. ADIABATIC ENDWALL THICK B.L.
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:42:36 79/311



ENDWALL HEAT TRANSFER LINEAR CASCADE
AIRFLOW
RUN #= 107
DATE= 11/07/79
EXPANSION RATIO= 2.122
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
PERCENT CHORD
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.
20.
40.
60.
80.
100.



EXIT MACH NO. = 1.10 REYNOLDS NO. = 2.83 X 10^6

RUN 107 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN #146 DATE: 11/07/79 TIME: 8:21:53

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
15.91	15.78	687.72	.109	.119	.179

IDEAL EXIT CONDITIONS

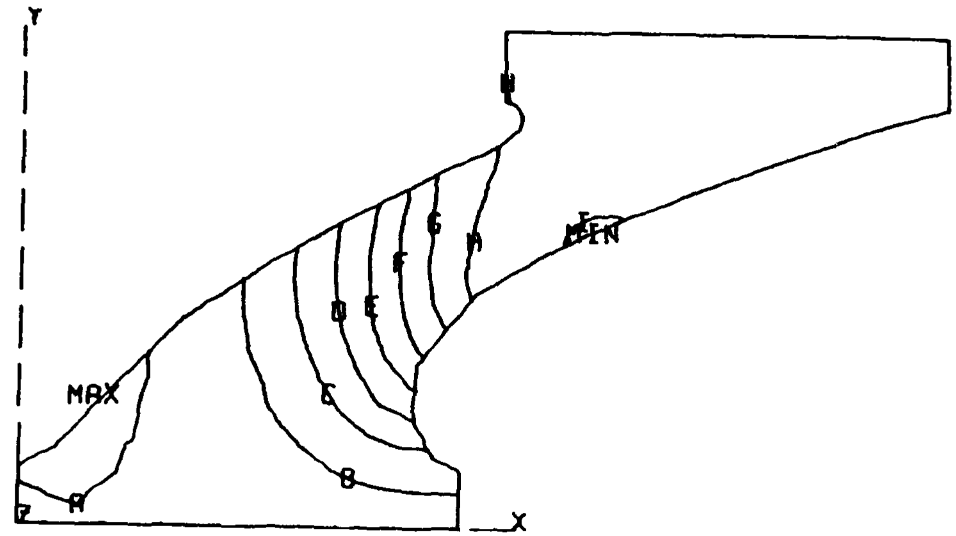
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
15.91	14.92	687.72	.306	.332	.484

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.067 STATIC PRESSURE RATIO= .945

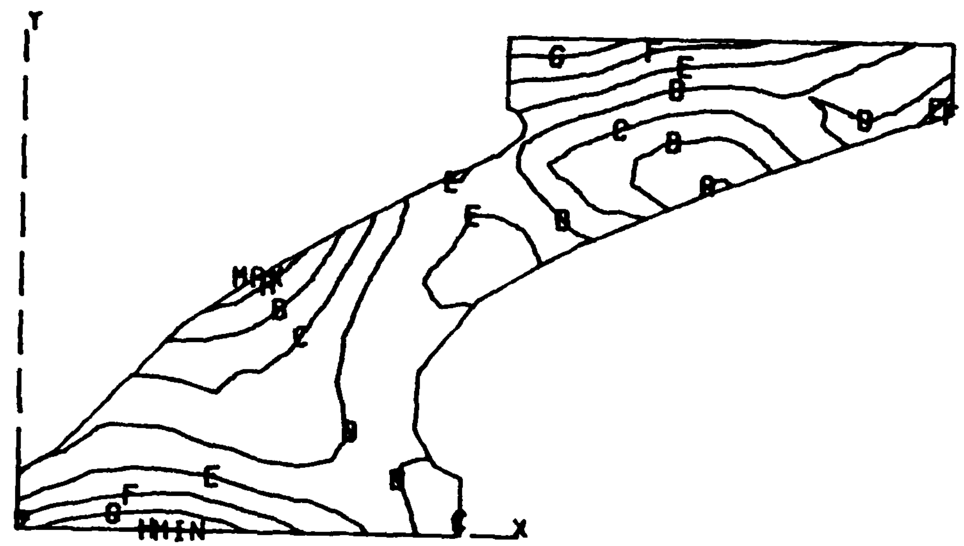
*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.0	.410	15.86	687.	.294	19.33	.0597	.0575
39.8	.410	15.85	687.	.294	19.34	.0649	.0625
29.8	.407	15.83	686.	.291	19.37	.0856	.0825
24.8	.405	15.81	686.	.289	19.43	.1014	.0977
19.6	.405	15.80	686.	.287	19.59	.1117	.1077
14.8	.390	15.81	685.	.286	18.93	.1115	.1076
12.3	.343	15.82	687.	.261	18.06	.1107	.1074
11.2	.332	15.82	687.	.261	17.44	.1098	.1065
10.7	.333	15.83	687.	.261	17.50	.1088	.1054
AVERAGE	.387	15.83	686.	.284	18.93	.0973	.0871



*** LEGEND ***	
	PSI
	(E-03)
A	15599.99
B	15499.99
C	15399.99
D	15299.99
E	15199.99
F	15099.99
G	14999.99
H	14899.99
I	14799.99
MAX	15621.22
MIN	14792.51

RUN 108 MACH .3 TGAS 200 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:58:27 80/158

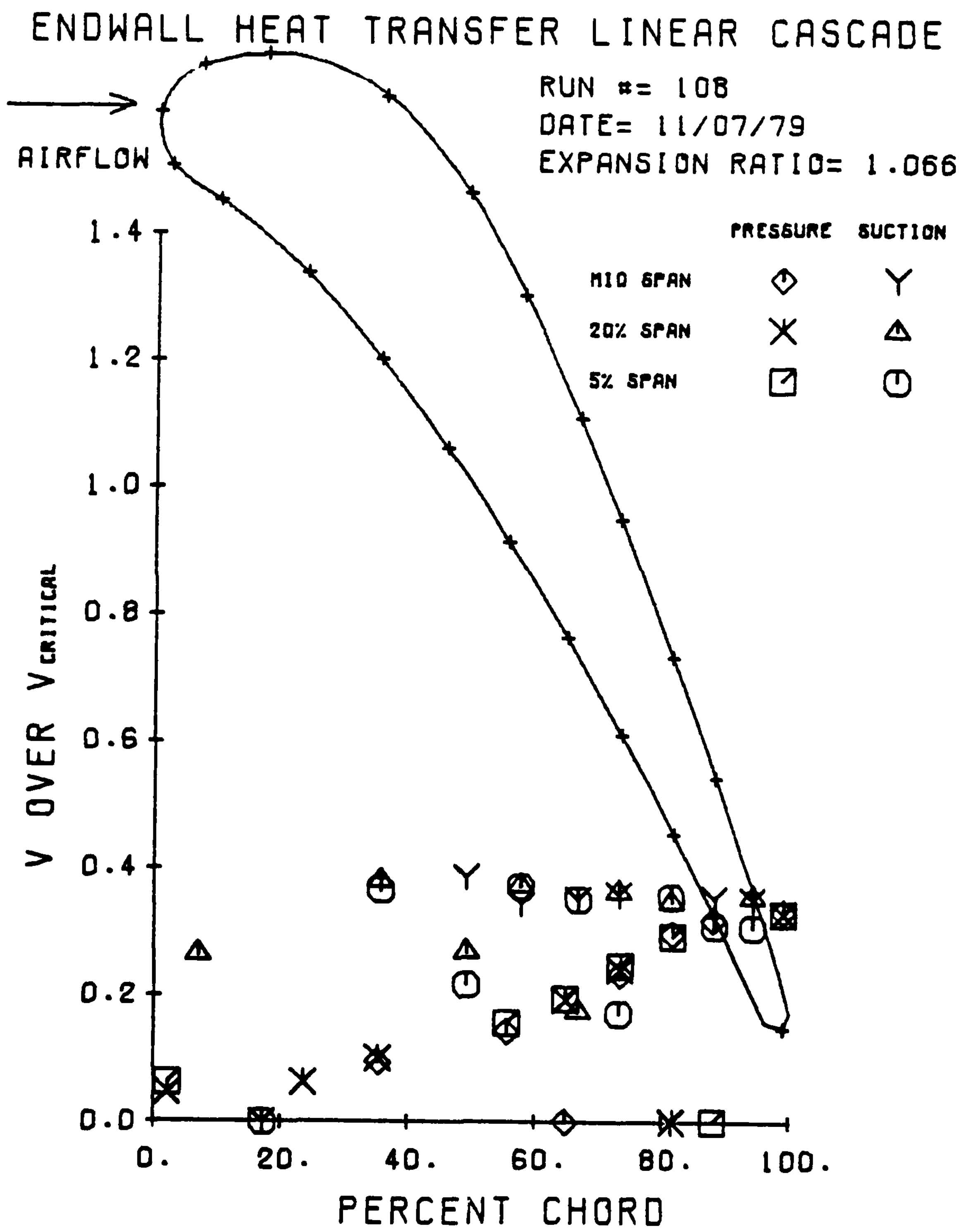


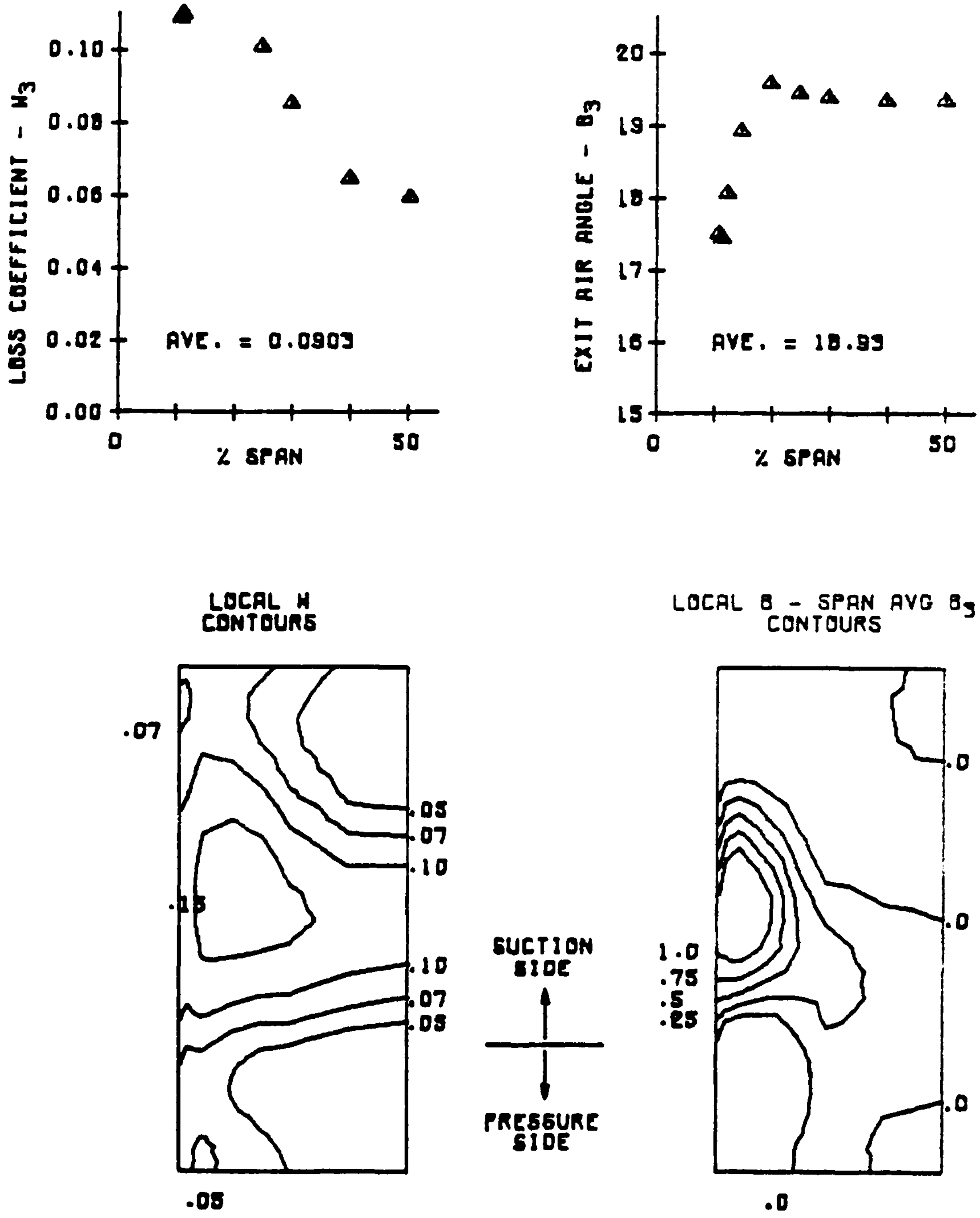
*** LEGEND ***

UNITS = TEMP

SYMBOL	CONTOUR
A	2.27700E 02
B	2.27500E 02
C	2.27300E 02
D	2.27100E 02
E	2.26900E 02
F	2.26700E 02
G	2.26500E 02
H	2.26300E 02
MAX	2.27796E 02
MIN	2.26285E 02

RUN 108 MACH .3 TGAS 200. ADIABATIC ENDWALL THICK B.L.
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 11:47:43 79/311


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 108
DATE= 11/07/79
EXPANSION RATIO= 1.066
AIRFLOW
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.31 REYNOLDS NO. = 4.84 X 10^5

RUN 108 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN #169 DATE: 11/19/79 TIME: 9:25:24

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
55.16	53.32	1259.33	.229	.244	.603

IDEAL EXIT CONDITIONS

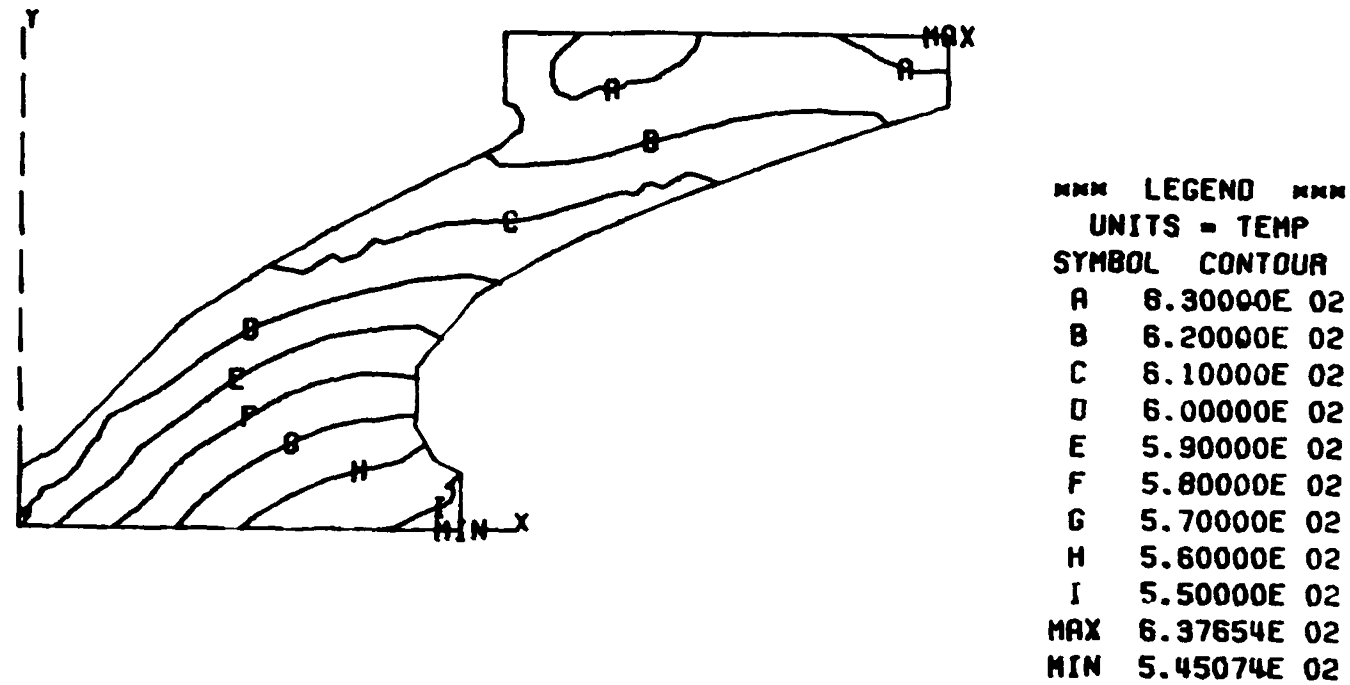
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
55.16	26.13	1259.33	1.116	1.100	1.818

CASCADE OPERATING CONDITION

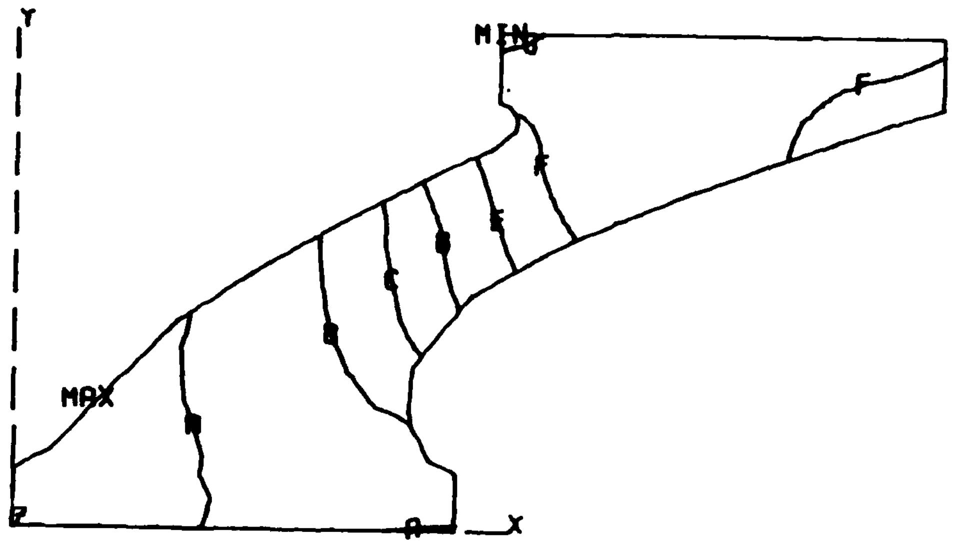
EXPANSION RATIO= 2.111 STATIC PRESSURE RATIO= .492

*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	FBAR
49.9	2.091	52.98	1207.	1.079	19.43	.0736	.0502
39.6	1.951	53.08	1173.	1.078	17.95	.0722	.0479
30.4	1.941	53.09	1194.	1.078	17.81	.0721	.0478
25.1	1.944	52.98	1139.	1.078	17.79	.0705	.0501
19.9	1.943	52.85	1162.	1.077	17.83	.0841	.0532
14.9	1.934	52.33	1176.	1.066	17.86	.0964	.0659
11.9	1.92[illegible]	51.99	1175.	1.061	17.9[illegible]	.11[illegible]	.0742
8.9	1.941	51.63	1167.	1.062	1[illegible].[illegible]	.1153	.0775
7.5	1.954	51.81	1167.	1.064	18.13	.1156	.0777
AVERAGE	1.961	52.65	1161.	1.073	1[illegible].[illegible]7	.[illegible]	.05[illegible]

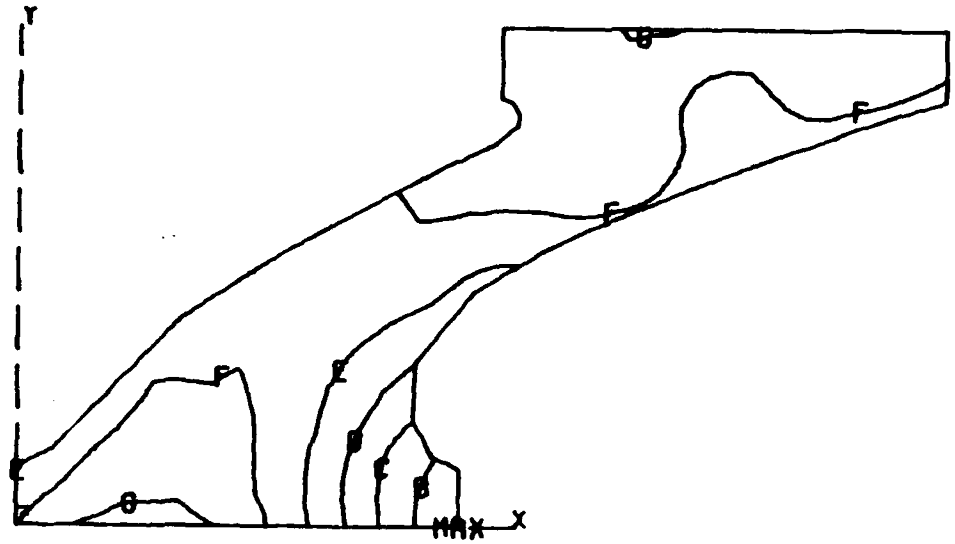


RUN 109 MACH 1.1 TGAS 800. THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:38:23 79/331



*** LEGEND ***	PSI
A	52.00
B	47.00
C	42.00
D	37.00
E	32.00
F	27.00
G	22.00
MAX	52.96
MIN	19.95

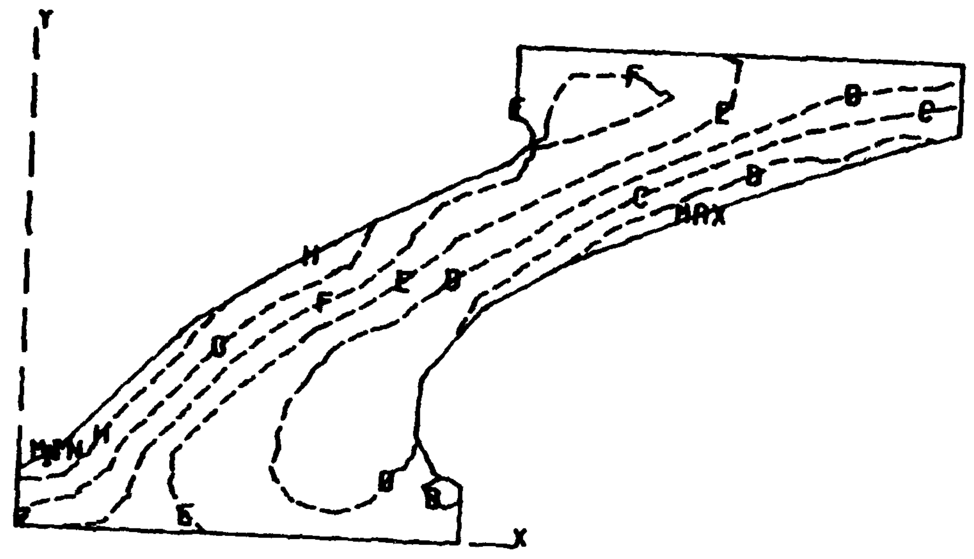
RUN 109 MACH 1.1 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:09:17 80/158



*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	7.12000E 02
B	7.06000E 02
C	7.00000E 02
D	6.94000E 02
E	6.88000E 02
F	6.82000E 02
G	6.76000E 02
MAX	7.12091E 02
MIN	6.73447E 02

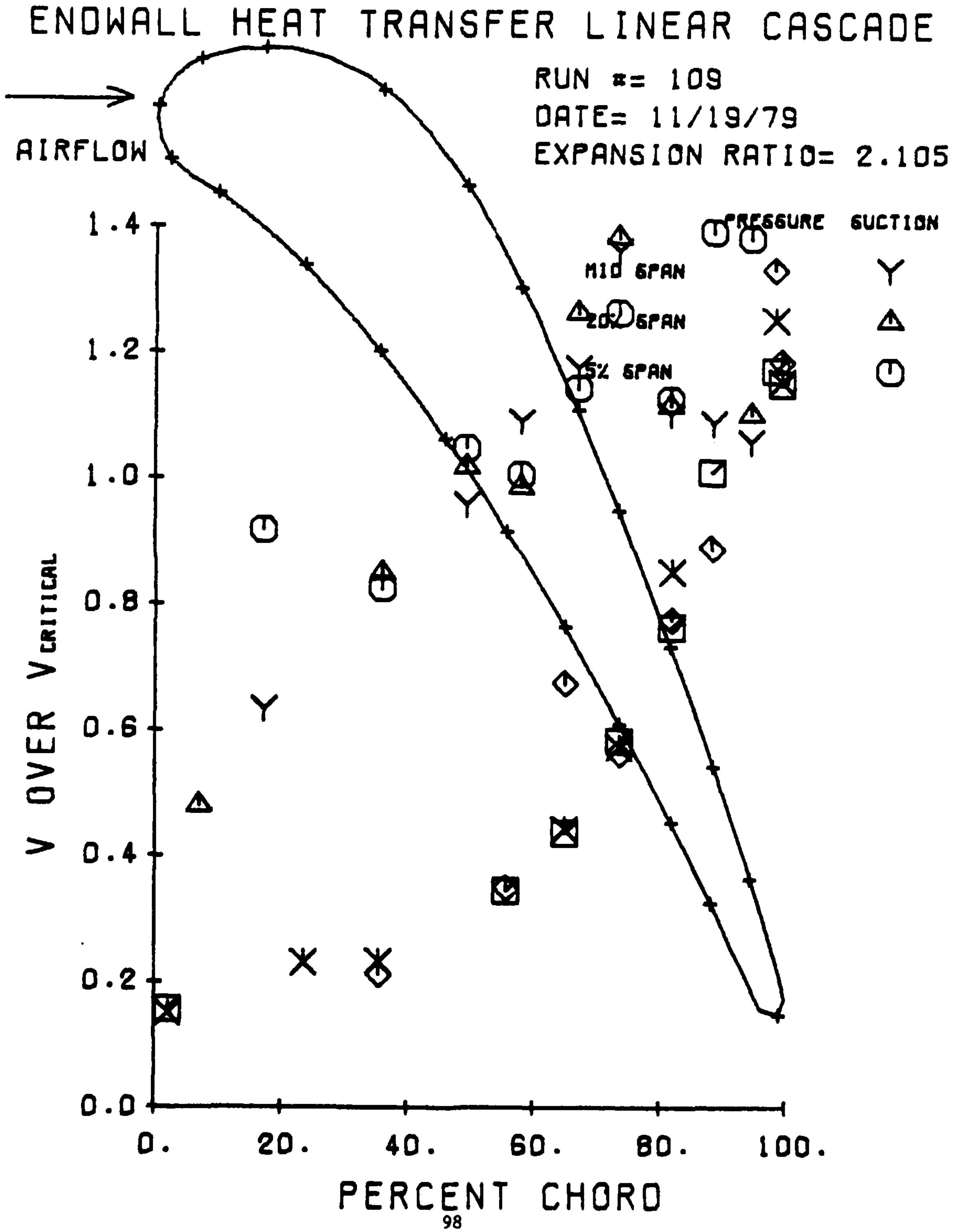
RUN 109 MACH 1.1 TGAS 800. THICK B.L. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0C00 PLOT TIME AND DATE = 10:26:30 79/331

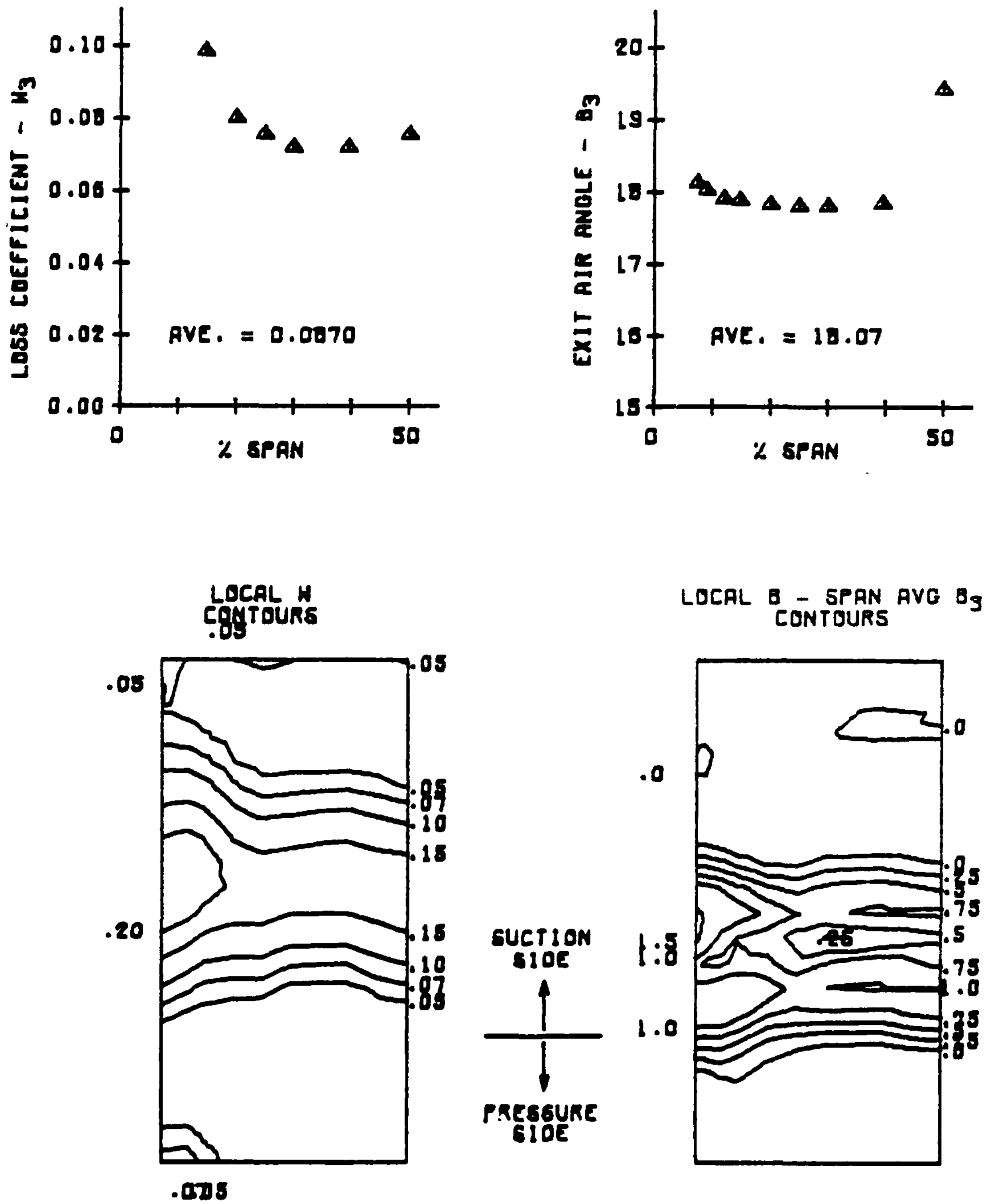


*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
B	-1.00000E-03
C	-2.00000E-03
D	-3.00000E-03
E	-4.00000E-03
F	-5.00000E-03
G	-5.99999E-03
H	-6.99999E-03
I	-7.99999E-03
MAX	-1.53242E-04
MIN	-8.16856E-03

RUN 109 MACH 1.1 TGAS 800. THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 12:46:27 79/331


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 109
DATE= 11/19/79
EXPANSION RATIO= 2.105
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
PERCENT CHORD
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.
20.
40.
60.
80.
100.



EXIT MACH NO. = 1.12 REYNOLDS NO. = 7.10×10^5

RUN 109 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN #111 DATE: 11/21/79 TIME: 12:16: 6

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
21.31	20.77	1267.02	.195	.211	.203

IDEAL EXIT CONDITIONS

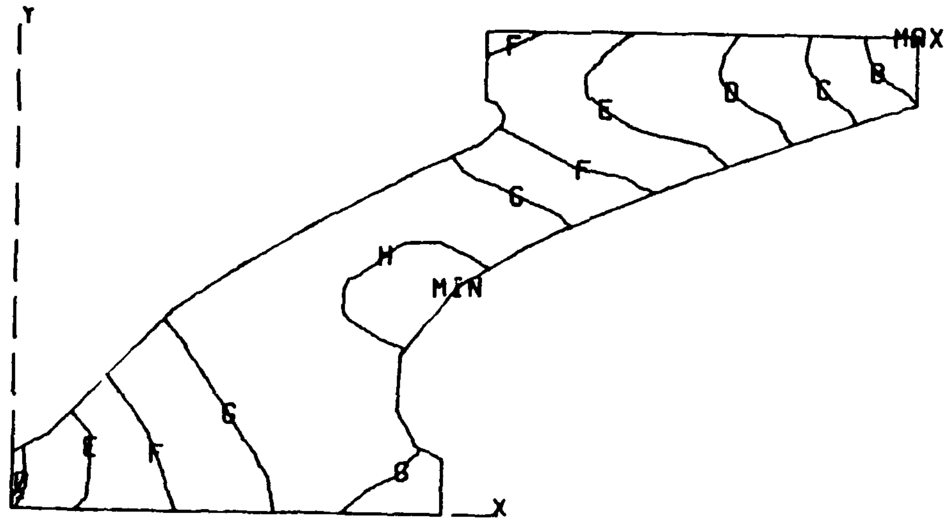
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
21.31	15.67	1267.02	.685	.715	.589

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.360 STATIC PRESSURE RATIO= .755

*** MIXED OUT CONDITION SUMMARY ***

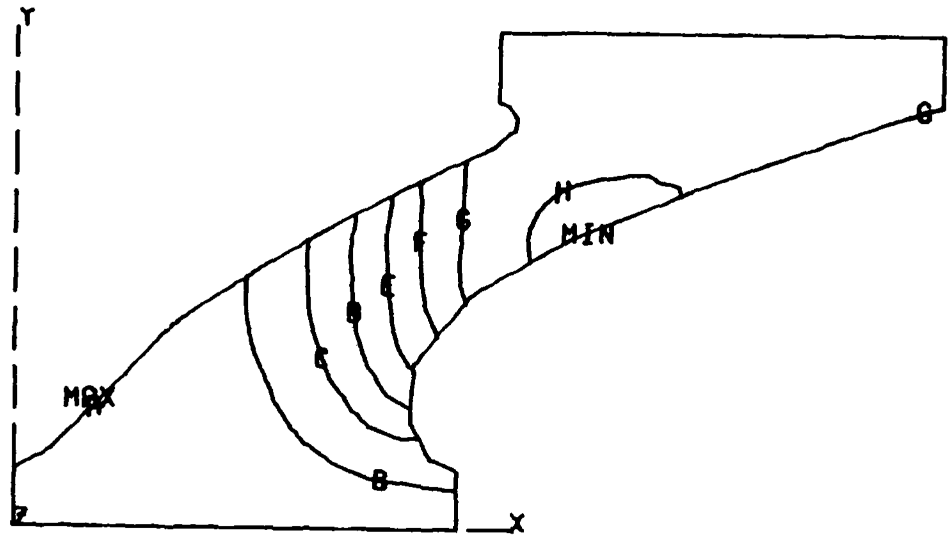
% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.2	.793	21.09	1237.	.675	20.54	.0395	.0329
40.0	.791	21.05	1248.	.675	20.57	.0449	.0373
30.0	.791	21.02	1211.	.673	20.32	.0513	.0427
24.9	.791	20.96	1214.	.670	20.45	.0616	.0514
19.7	.770	20.86	1267.	.664	20.52	.0794	.0663
14.8	.773	20.77	1227.	.659	20.45	.0946	.0793
11.9	.771	20.77	1232.	.658	20.44	.0948	.0795
9.0	.737	20.74	1229.	.656	19.56	.1002	.0841
7.3	.720	20.72	1243.	.654	19.23	.1043	.0876
AVERAGE	.773	20.92	1235.	.667	20.25	.0687	.0574



*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	5.26000E 02
B	5.18000E 02
C	5.10000E 02
D	5.02000E 02
E	4.94000E 02
F	4.86000E 02
G	4.78000E 02
H	4.70000E 02
MAX	5.26098E 02
MIN	4.67791E 02

JN 111 MACH .7 TGAS 800 THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 14:01:06 79/331



***	LEGEND	***
	PSI	
	(E-03)	
A	20999.98	
B	20199.98	
C	19399.98	
D	18599.97	
E	17799.97	
F	16999.97	
G	16199.96	
H	15399.96	
MAX	21001.79	
MIN	15092.55	

RUN 111 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:44:18 80/161

AD-A110 333   GENERAL MOTORS CORP INDIANAPOLIS IN DETROIT DIESEL A--ETC F/G 21/5
EXPERIMENTAL INVESTIGATION OF TURBINE ENDWALL HEAT TRANSFER. VO--ETC(U)
AUG 81 L D HYLTON, M S MIHELC, E R TURNER   F33615-77-C-2030

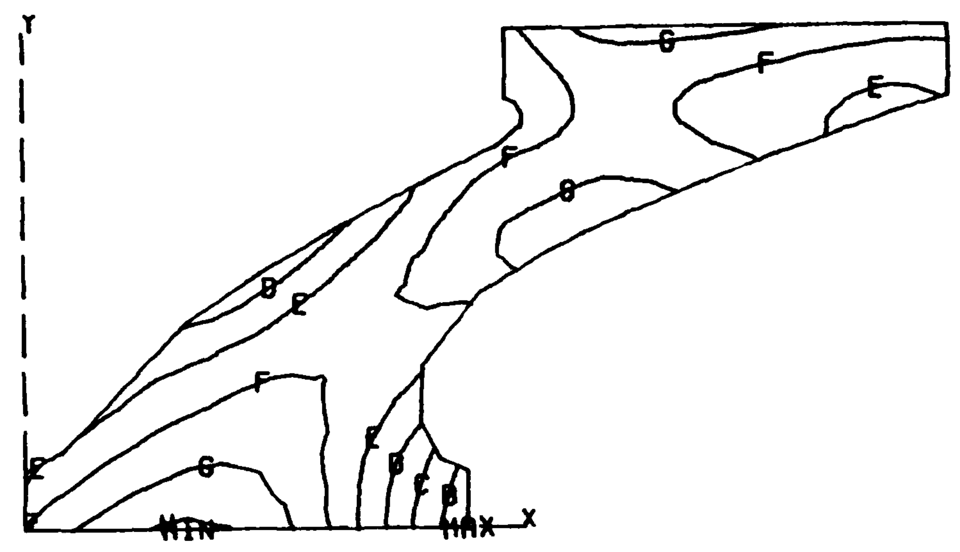
UNCLASSIFIED   DDA-EDR-10363-VOL-2   AFWAL-TR-81-2077-VOL-2   NL

2 of 4

1.0 1.1 1.25 1.4 1.6 1.8 2.0 2.2 2.5 2.8 3.2 3.6 4.0 4.5 5.0 5.6 6.3

MICROCOPY RESOLUTION TEST CHART

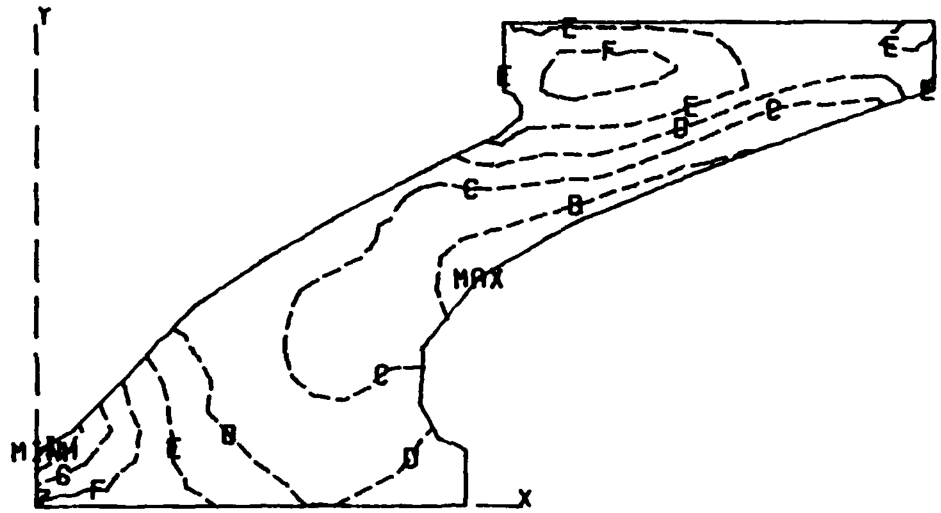
NATIONAL BUREAU OF STANDARDS-1963-A



*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	7.36000E 02
B	7.30000E 02
C	7.24000E 02
D	7.18000E 02
E	7.12000E 02
F	7.06000E 02
G	7.00000E 02
H	6.94000E 02
MAX	7.36035E 02
MIN	6.92656E 02

RUN 111 MACH .7 TGAS 800 THICK B.L. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 11:59:53 79/331



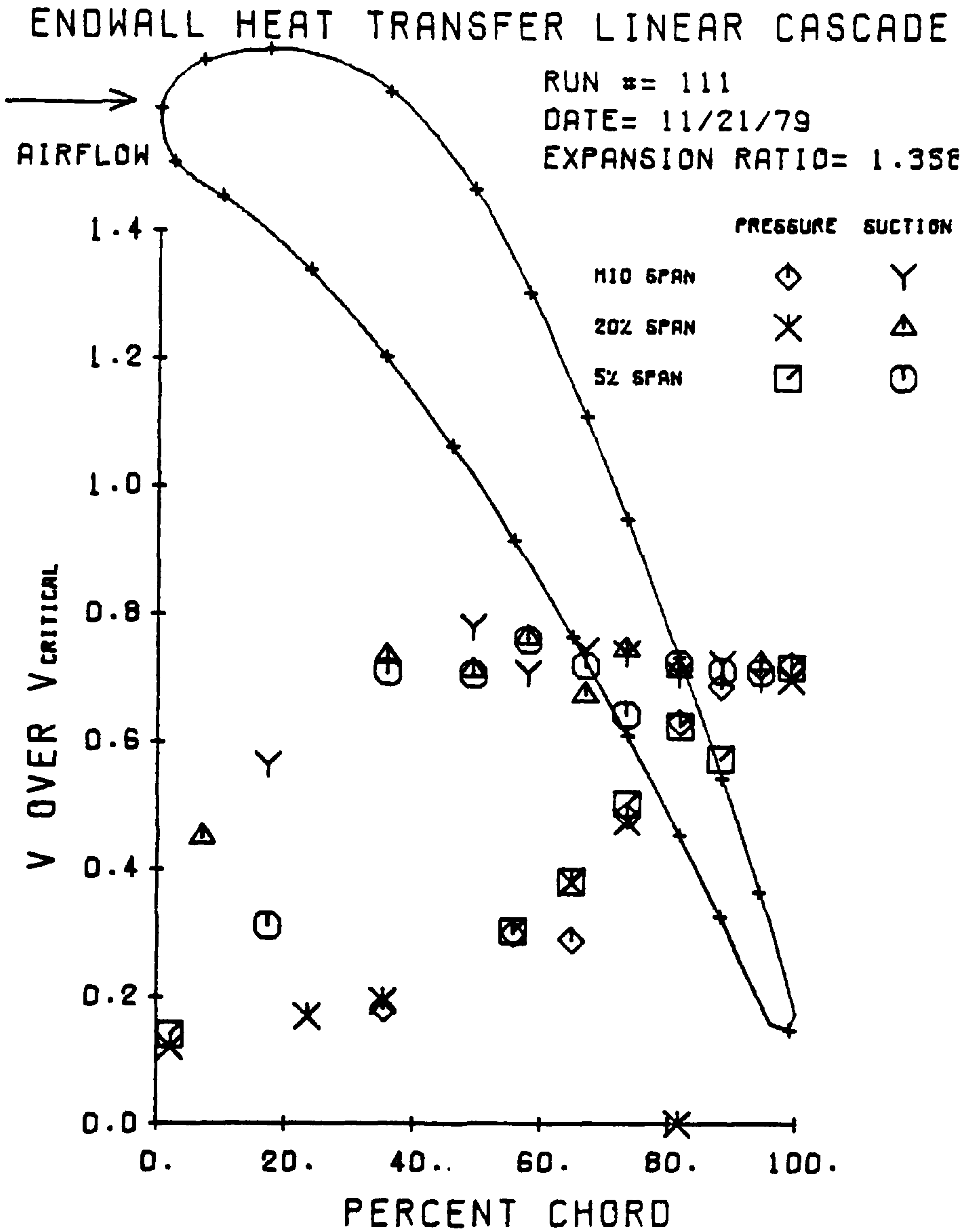
SYMBOL	CONTOUR
A	-1.00000E-03
B	-2.00000E-03
C	-3.00000E-03
D	-4.00000E-03
E	-5.00000E-03
F	-5.99999E-03
G	-6.99999E-03
H	-7.99999E-03
I	-8.99999E-03
MAX	-1.17523E-03
MIN	-9.47570E-03

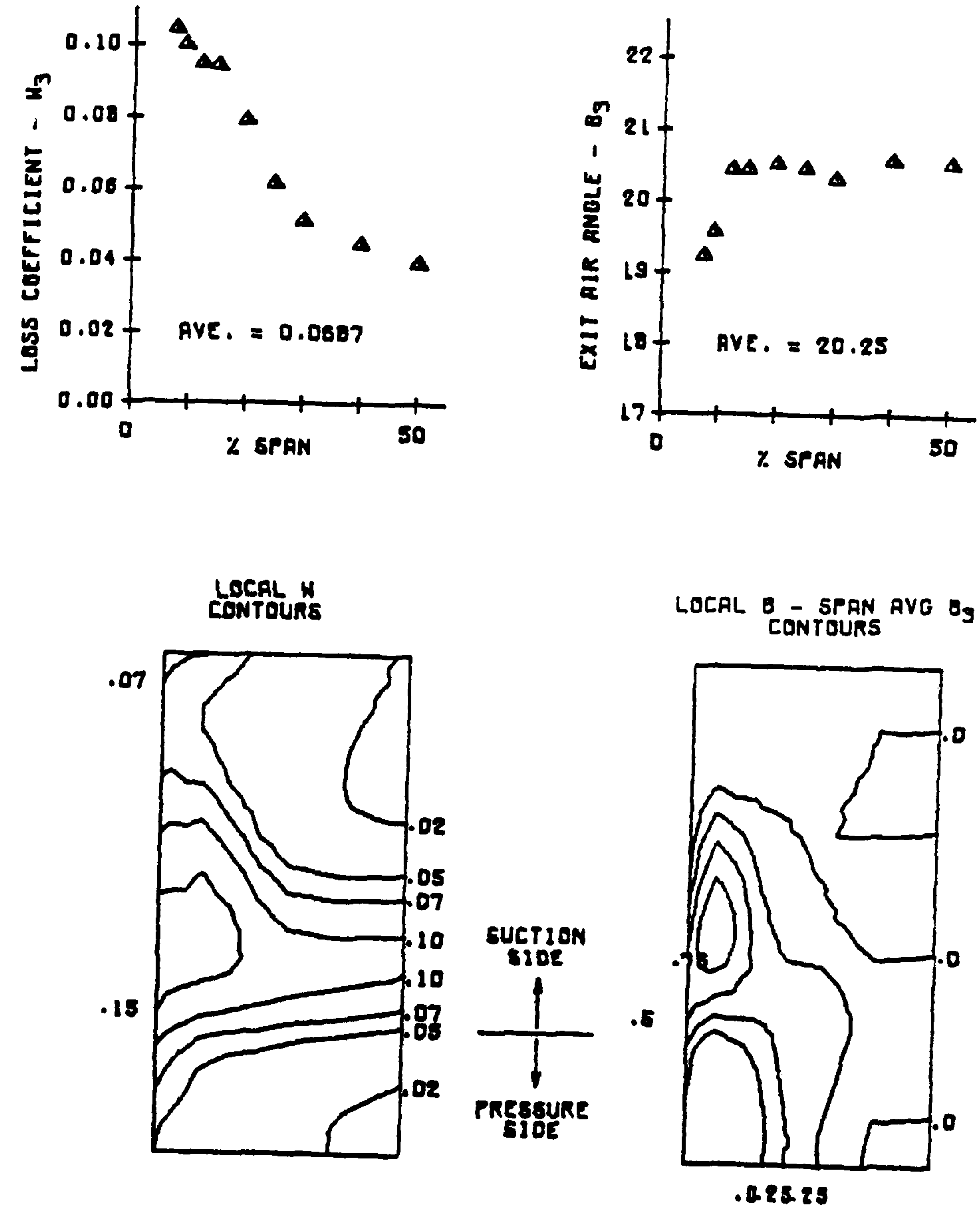
*** LEGEND ***

UNITS = TEMP

RUN 111 MACH .7 TGAS 800 THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 14:02:03 79/331


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 111
DATE= 11/21/79
EXPANSION RATIO= 1.35E
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V OVER V CRITICAL
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.69 REYNOLDS NO. = 5.89 X 10^5

RUN 111 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN #112 DATE: 11/27/79 TIME: 12:42:14

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
22.34	21.72	1065.52	.203	.221	.272

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
22.34	15.92	1065.52	.718	.748	.779

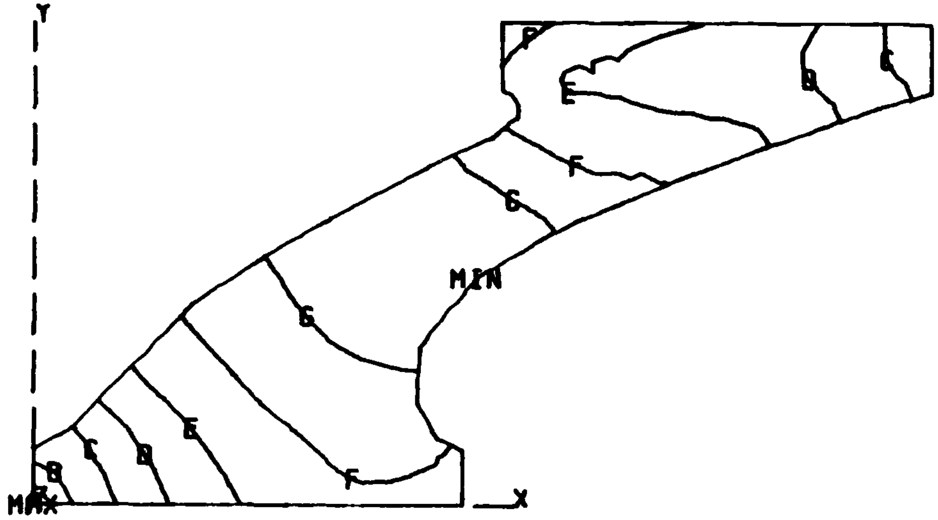
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.403 STATIC PRESSURE RATIO= .733

*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
49.8	.921	22.08	1035.	.703	20.38	.0408	.0333
40.4	.913	22.06	1042.	.701	20.21	.0442	.0361
30.2	.914	22.02	1037.	.698	20.27	.0509	.0417
24.7	.917	21.95	1028.	.693	20.40	.0621	.0510
19.8	.923	21.84	1018.	.686	20.63	.0792	.0653
14.8	.931	21.76	1014.	.679	20.96	.0926	.0766
12.5	.921	21.74	1006.	.677	20.72	.0960	.0795
8.9	.900	21.72	994.	.673	20.17	.1002	.0832
7.7	.880	21.71	992.	.671	19.72	.1223	.0850
AVERAGE	.911	21.91	1022.	.689	20.30	.0691	.0570

PRECEDING PAGE BLANK-NOT FILMED

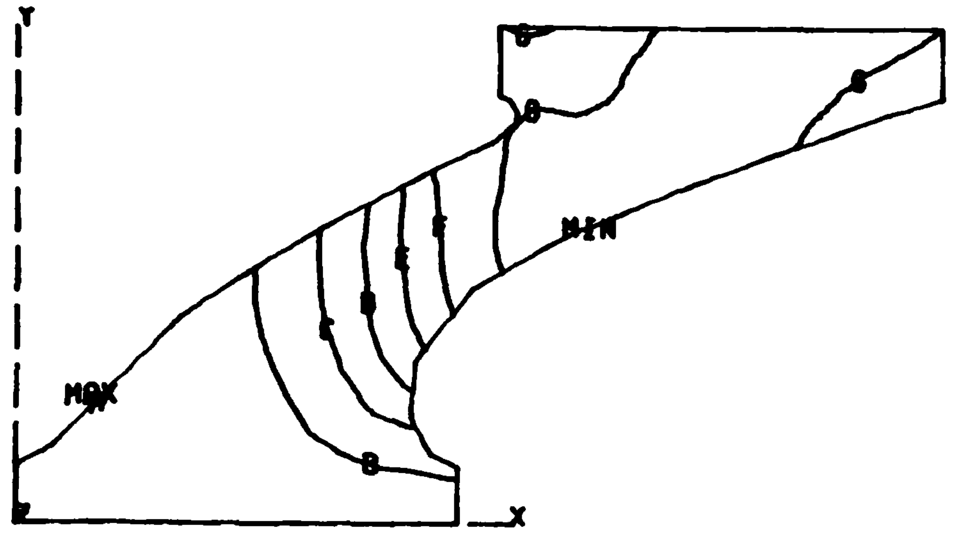


*** LEGEND ***

UNITS = TEMP

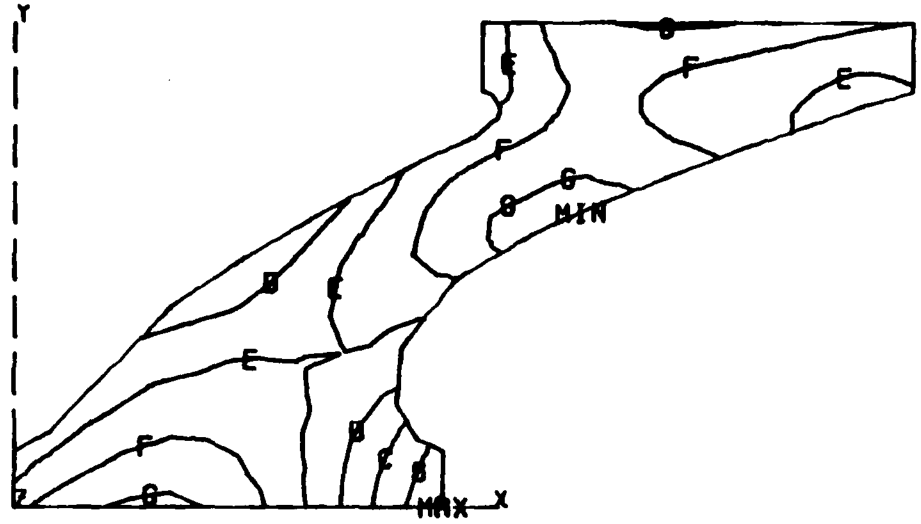
SYMBOL	CONTOUR
A	4.30000E 02
B	4.23000E 02
C	4.16000E 02
D	4.09000E 02
E	4.02000E 02
F	3.95000E 02
G	3.88000E 02
MAX	4.30473E 02
MIN	3.82642E 02

RUN 112 MACH .7 TGAS 600 THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 21:24:23 79/346



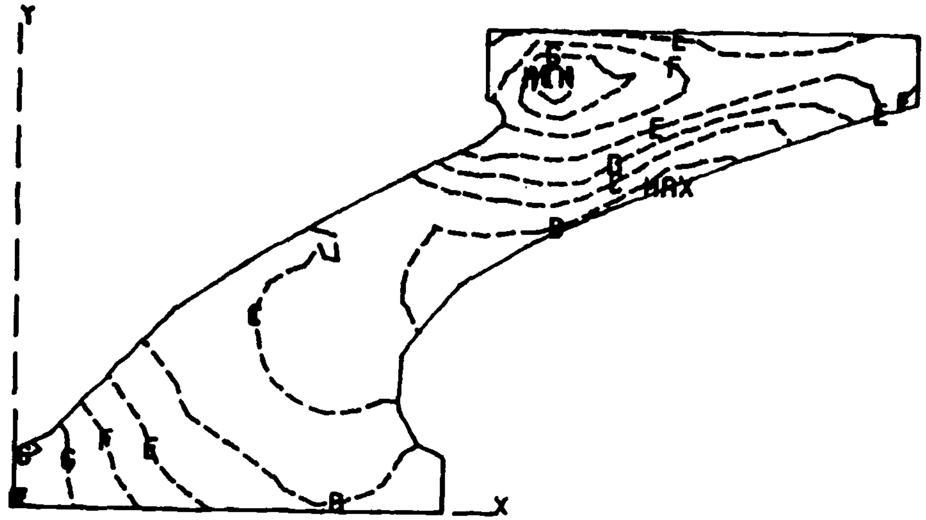
*** LEGEND ***	PSI (E-03)
A	21999.98
B	20999.98
C	19999.98
D	18999.98
E	17999.98
F	16999.98
G	15999.98
MAX	22004.74
MIN	15260.77

RUN 112 MACH .7 TGAS 600 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:09:45 80/161



*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	5.69000E 02
B	5.65000E 02
C	5.61000E 02
D	5.57000E 02
E	5.53000E 02
F	5.49000E 02
G	5.45000E 02
MAX	5.69250E 02
MIN	5.43969E 02

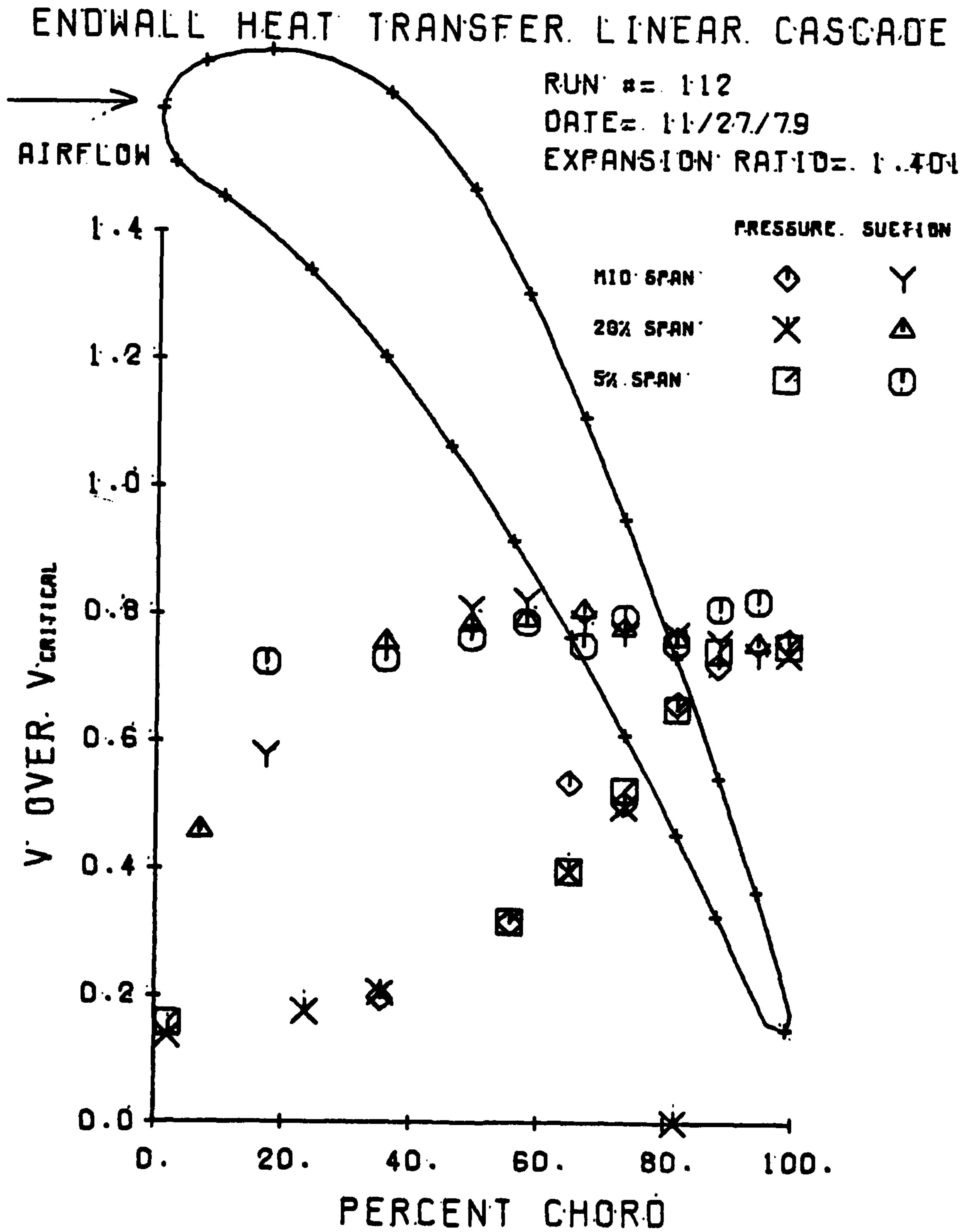
RUN 112 MACH .7 TGAS 600 THICK B.L. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:13:05 79/331

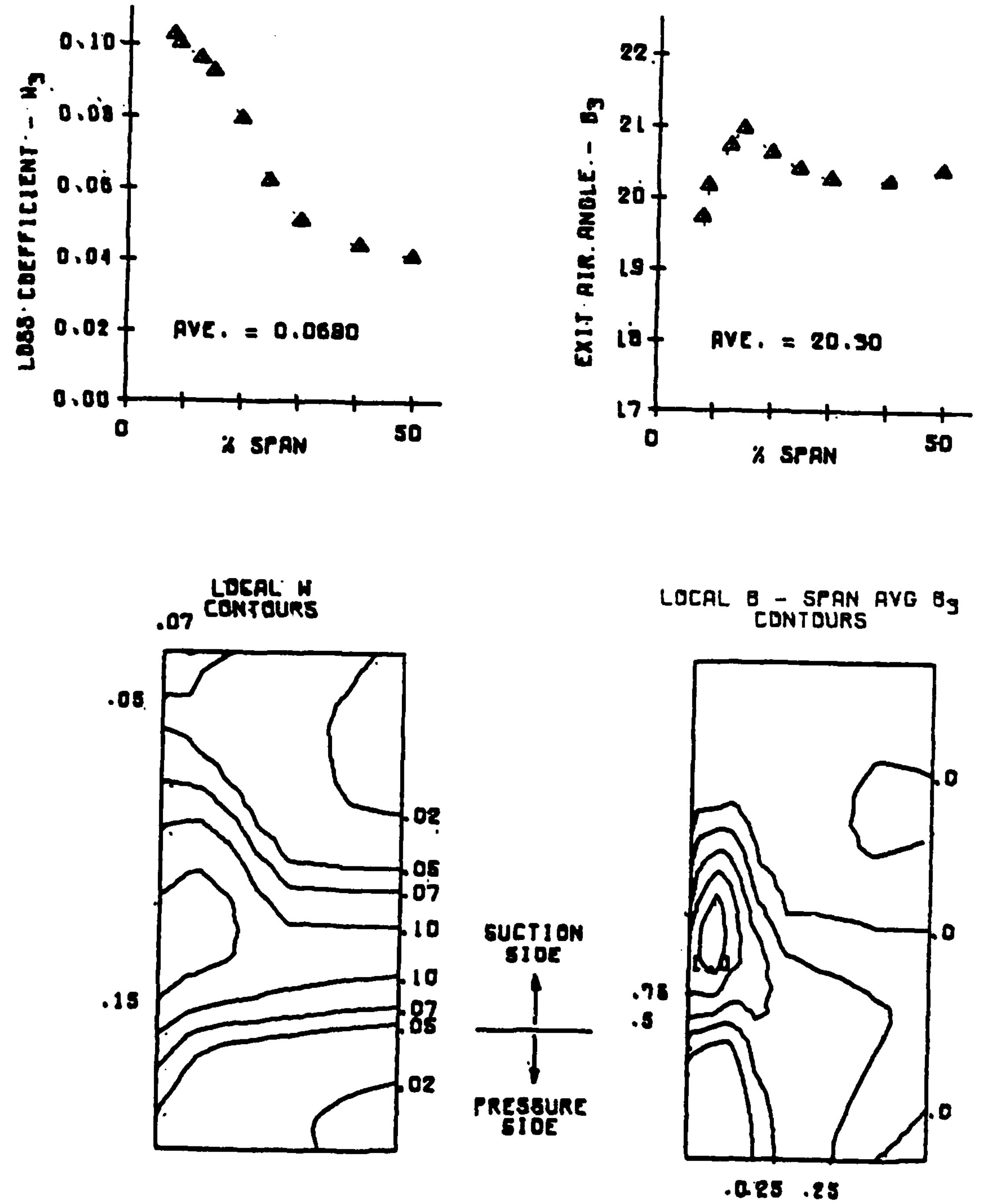


*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	-1.00000E-03
B	-2.00000E-03
C	-3.00000E-03
D	-4.00000E-03
E	-5.00000E-03
F	-5.99999E-03
G	-6.99999E-03
H	-7.99999E-03
MAX	-1.09463E-03
MIN	-8.86411E-03

RUN 112 MACH .7 TGAS 600 THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 21:24:43 79/346


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 112
DATE= 11/27/79
EXPANSION RATIO= 1.401
AIRFLOW
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
V OVER V CRITICAL
PERCENT CHORD



EXIT MACH NO. = 0.72 REYNOLDS NO. = 7.79 X 10^5

RUN 112 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN #113 DATE: 11/27/79 TIME: 13:53:51

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
22.41	21.78	1460.07	.207	.224	.193

IDEAL EXIT CONDITIONS

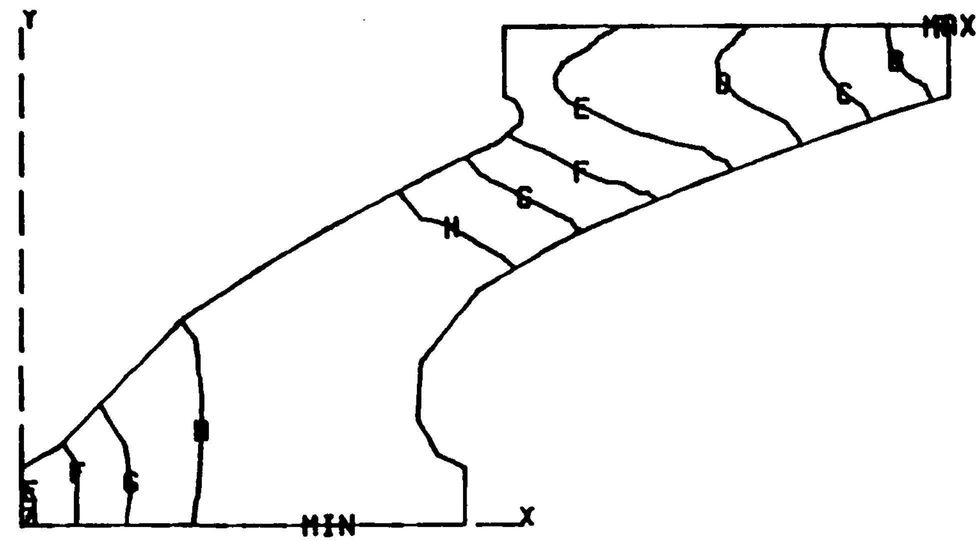
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
22.41	15.99	1460.07	.723	.750	.541

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.402 STATIC PRESSURE RATIO= .734

*** MIXED OUT CONDITION SUMMARY ***

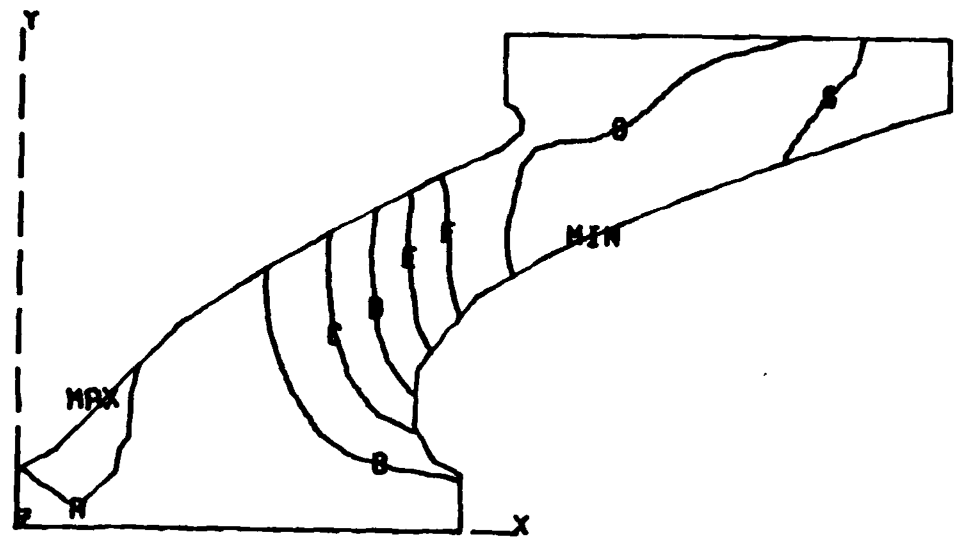
% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.1	.783	22.14	1401.	.705	20.17	.0421	.0346
39.9	.779	22.13	1389.	.703	19.97	.0453	.0372
29.9	.785	22.08	1381.	.700	20.12	.0524	.0431
25.8	.780	22.02	1406.	.698	20.31	.0618	.0508
19.8	.776	21.90	1376.	.693	20.12	.0801	.0661
14.9	.786	21.80	1359.	.686	20.50	.0958	.0794
11.6	.788	21.77	1389.	.686	20.78	.1004	.0832
9.5	.768	21.74	1356.	.685	20.06	.1059	.0878
7.7	.745	21.76	1369.	.666	19.48	.1018	.0843
AVERAGE	.775	21.97	1382.	.695	20.07	.0703	.0580



*** LEGEND ***
UNITS = TEMP

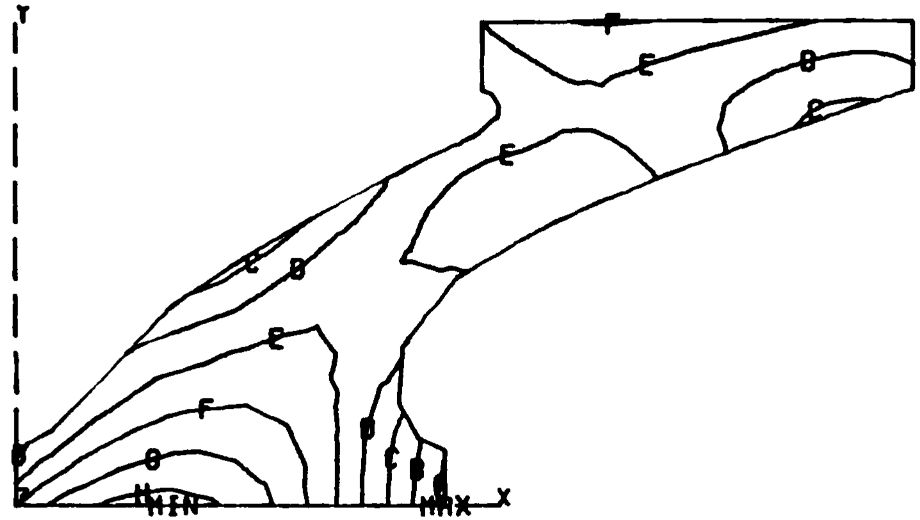
SYMBOL	CONTOUR
A	6.10000E 02
B	6.00000E 02
C	5.90000E 02
D	5.80000E 02
E	5.70000E 02
F	5.60000E 02
G	5.50000E 02
H	5.40000E 02
MAX	6.11269E 02
MIN	5.30661E 02

RUN 113 MACH .7 TGAS 1000 THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 18:07:23 79/331



***	LEGEND ***
	PSI
	(E-03)
A	21999.98
B	20999.98
C	19999.98
D	18999.98
E	17999.98
F	16999.98
G	15999.98
MAX	22097.33
MIN	15372.94

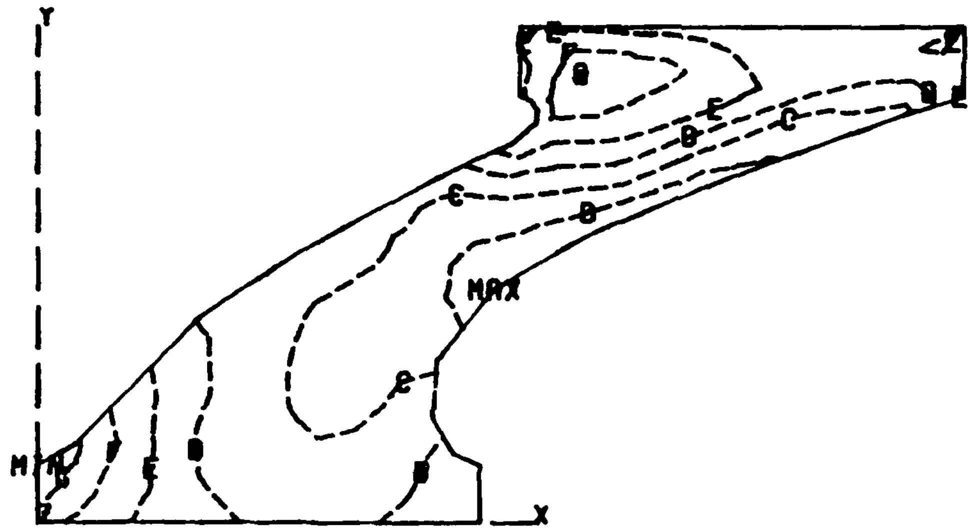
RUN 113 MACH .7 TGAS 1000 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:14:54 80/161



SYMBOL	CONTOUR
A	8.50000E 02
B	8.40000E 02
C	8.30000E 02
D	8.20000E 02
E	8.10000E 02
F	8.00000E 02
G	7.90000E 02
H	7.80000E 02
MAX	8.53562E 02
MIN	7.75487E 02

*** LEGEND ***
UNITS = TEMP

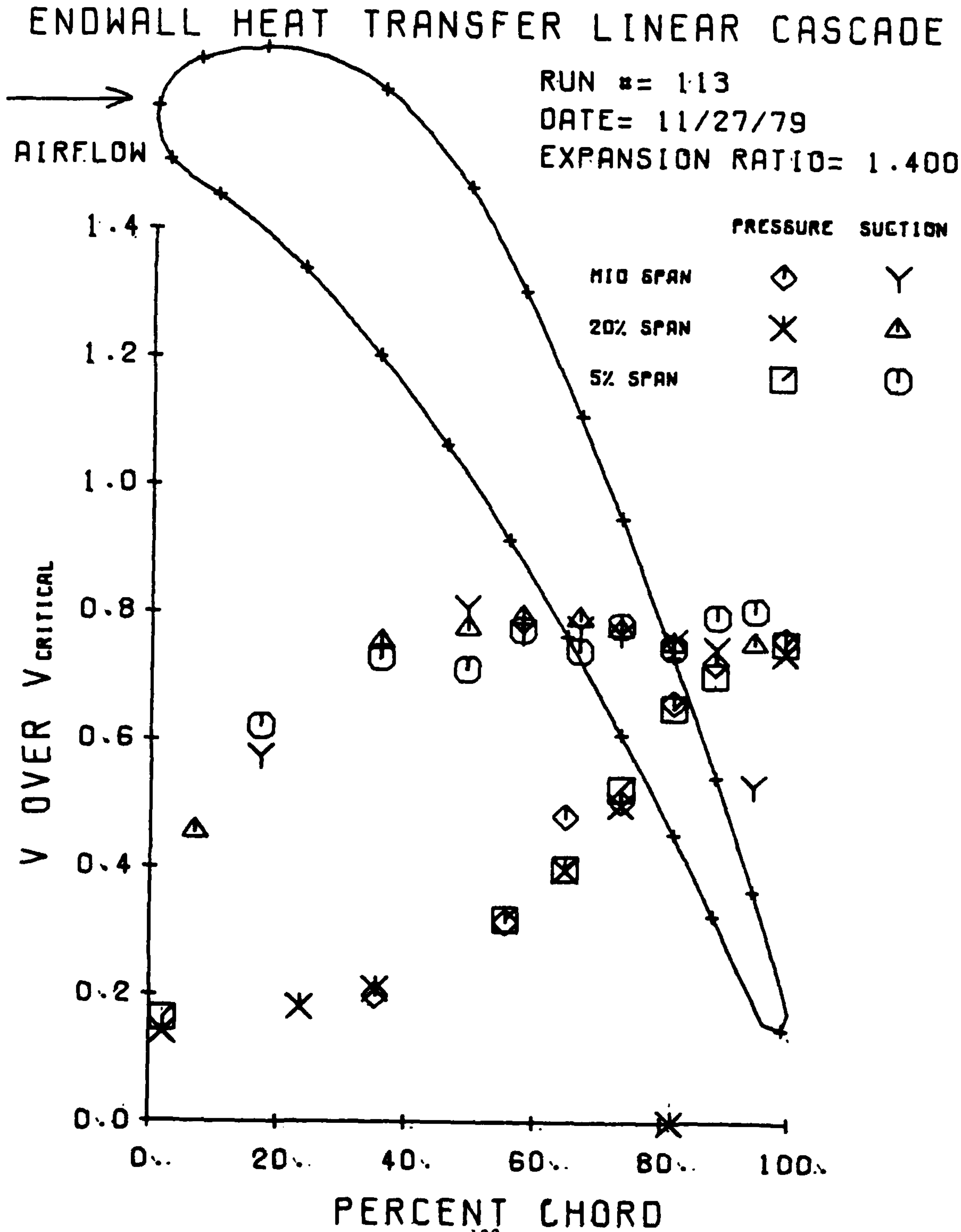
RUN 113 MACH .7 TGAS 1000 THICK B.L. ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:20:07 79/331

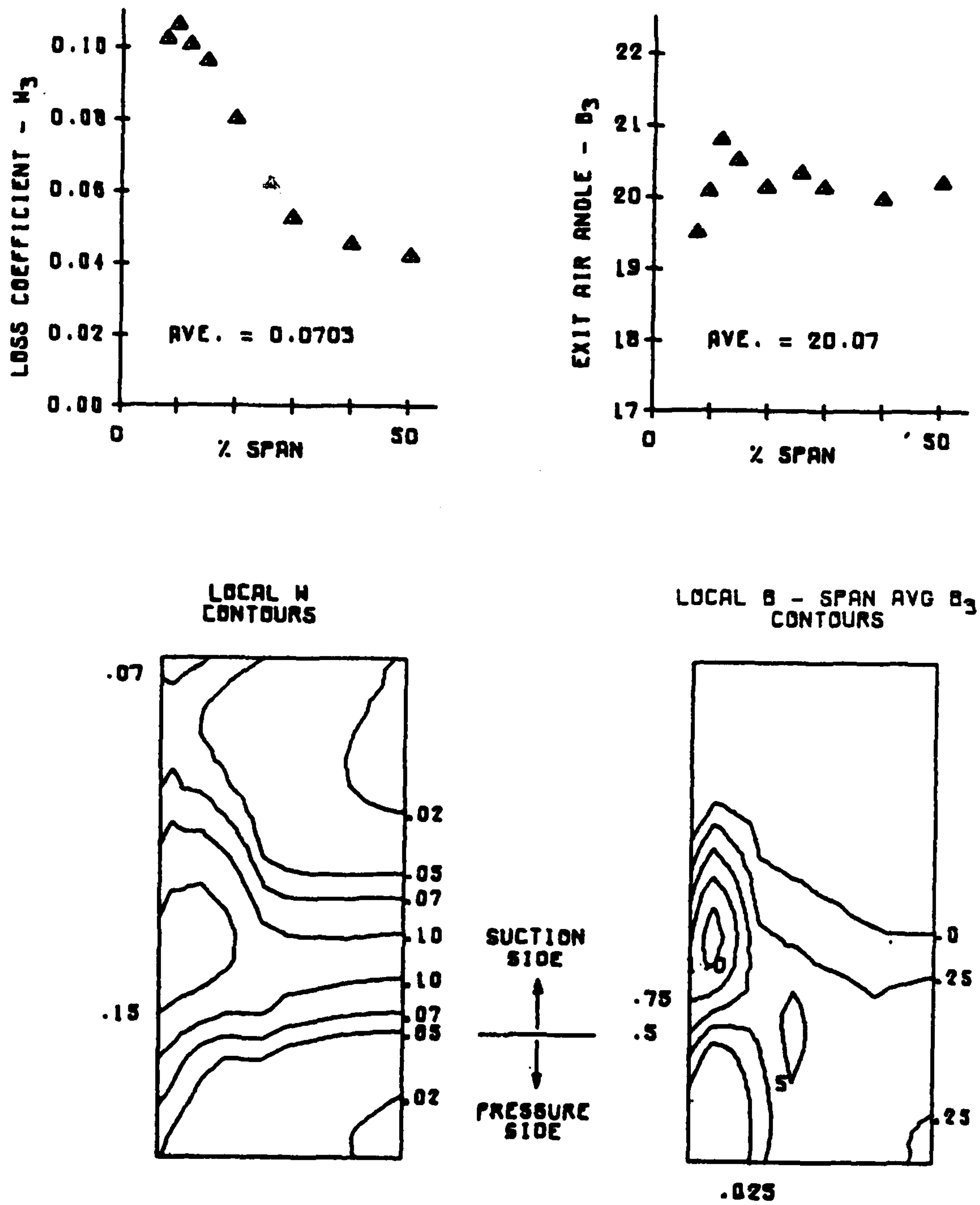


*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	-1.40000E-03
B	-2.20000E-03
C	-3.00000E-03
D	-3.80000E-03
E	-4.60000E-03
F	-5.39999E-03
G	-6.19999E-03
MAX	-1.40029E-03
MIN	-6.78639E-03

RUN 113 MACH .7 TGAS 1000 THICK B.L. HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 18:08:10 79/331


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 113
DATE= 11/27/79
EXPANSION RATIO= 1.400
AIRFLOW
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
PERCENT CHORD
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.
20.
40.
60.
80.
100.



EXIT MACH NO. = 0.72 REYNOLDS NO. = 5.41 X 10^5

<u>RUN 113 AERODYNAMIC EXIT DATA</u>

GMA 200 TURBINE VANE CASCADE

RUN #114 DATE: 11/27/79 TIME: 14:40: 4

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
15.50	15.39	1236.35	.104	.113	.082

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
15.50	14.71	1236.35	.278	.300	.213

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.054 STATIC PRESSURE RATIO= .956

*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	FBAR
49.9	.302	15.45	1208.	.269	21.29	.0655	.0635
39.6	.303	15.44	1232.	.268	21.65	.0750	.0727
30.3	.298	15.45	1212.	.266	21.27	.0736	.0714
24.7	.302	15.44	1203.	.264	21.65	.0860	.0835
19.9	.296	15.42	1176.	.261	21.19	.1081	.1050
14.9	.289	15.42	1201.	.260	20.96	.1059	.1028
12.4	.281	15.42	1195.	.260	20.28	.1119	.1087
9.4	.284	15.42	1167.	.257	19.00	.1121	.1090
7.6	.256	15.42	1172.	.258	18.56	.1135	.1103
AVERAGE	.294	15.43	1202.	.264	20.81	.0901	.0874

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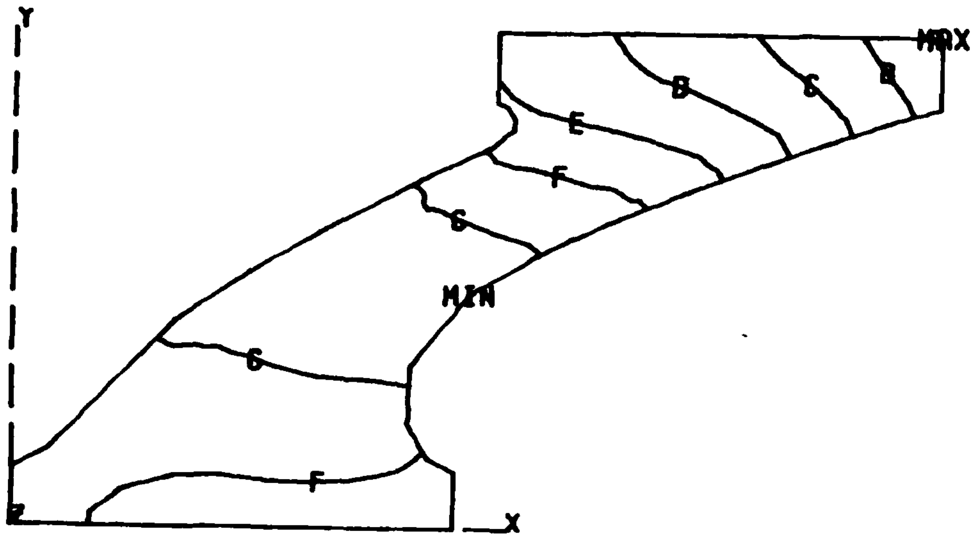
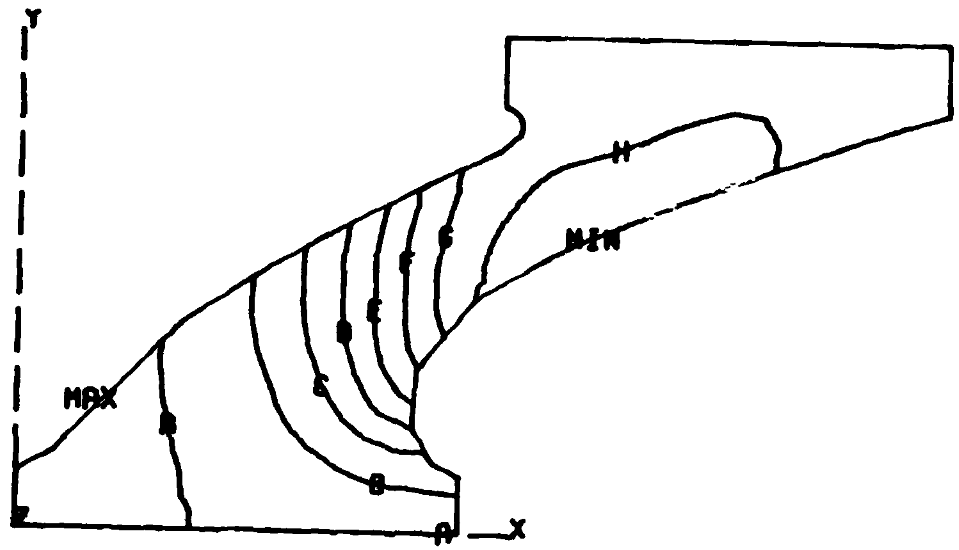


*** LEGEND ***	F
A	425.00
B	417.00
C	409.00
D	401.00
E	393.00
F	385.00
G	377.00
MAX	425.90
MIN	373.05

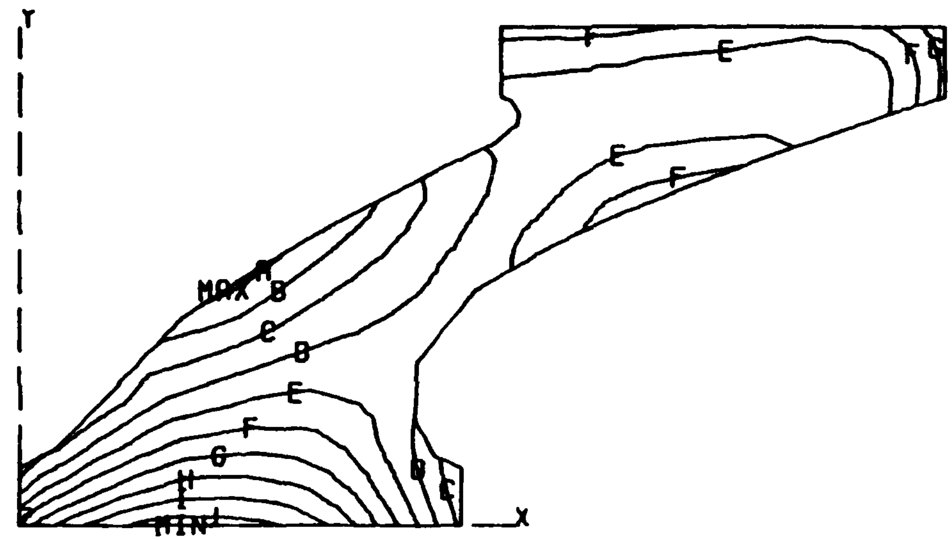
RUN 114 MACH .3 TGAS 800 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 18:02:43 80/014



*** LEGEND ***
PSI
(E-03)

A	15399.99
B	15299.99
C	15199.99
D	15099.99
E	14999.99
F	14899.99
G	14799.99
H	14699.99
MAX	15431.57
MIN	14628.81

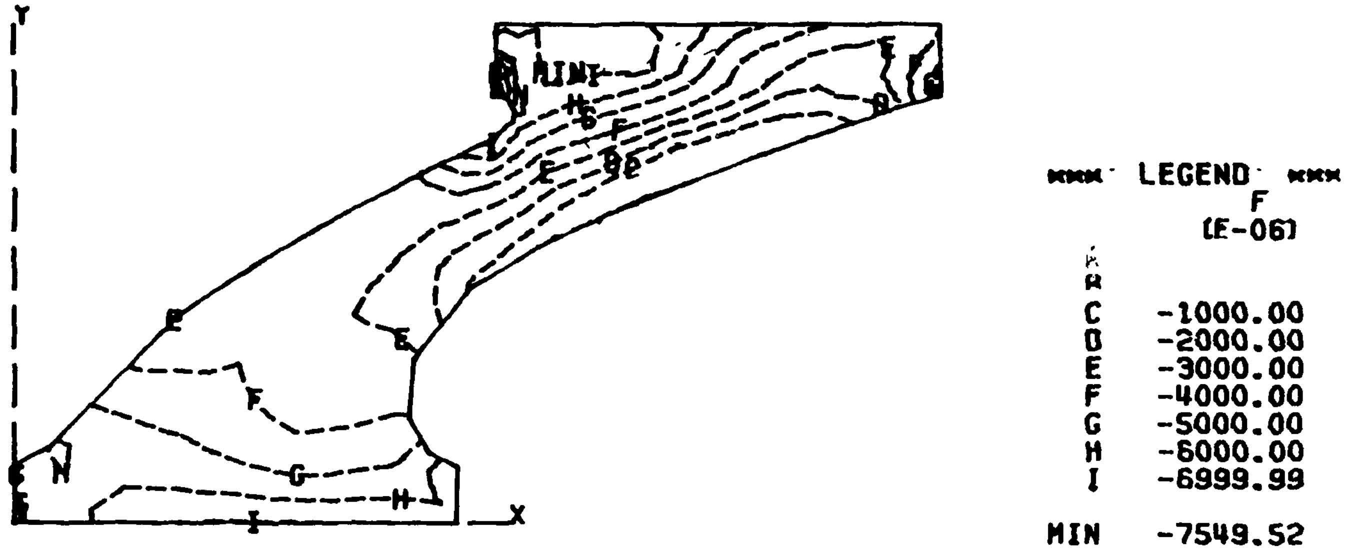
RUN 114 MACH .3 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:21:32 80/181



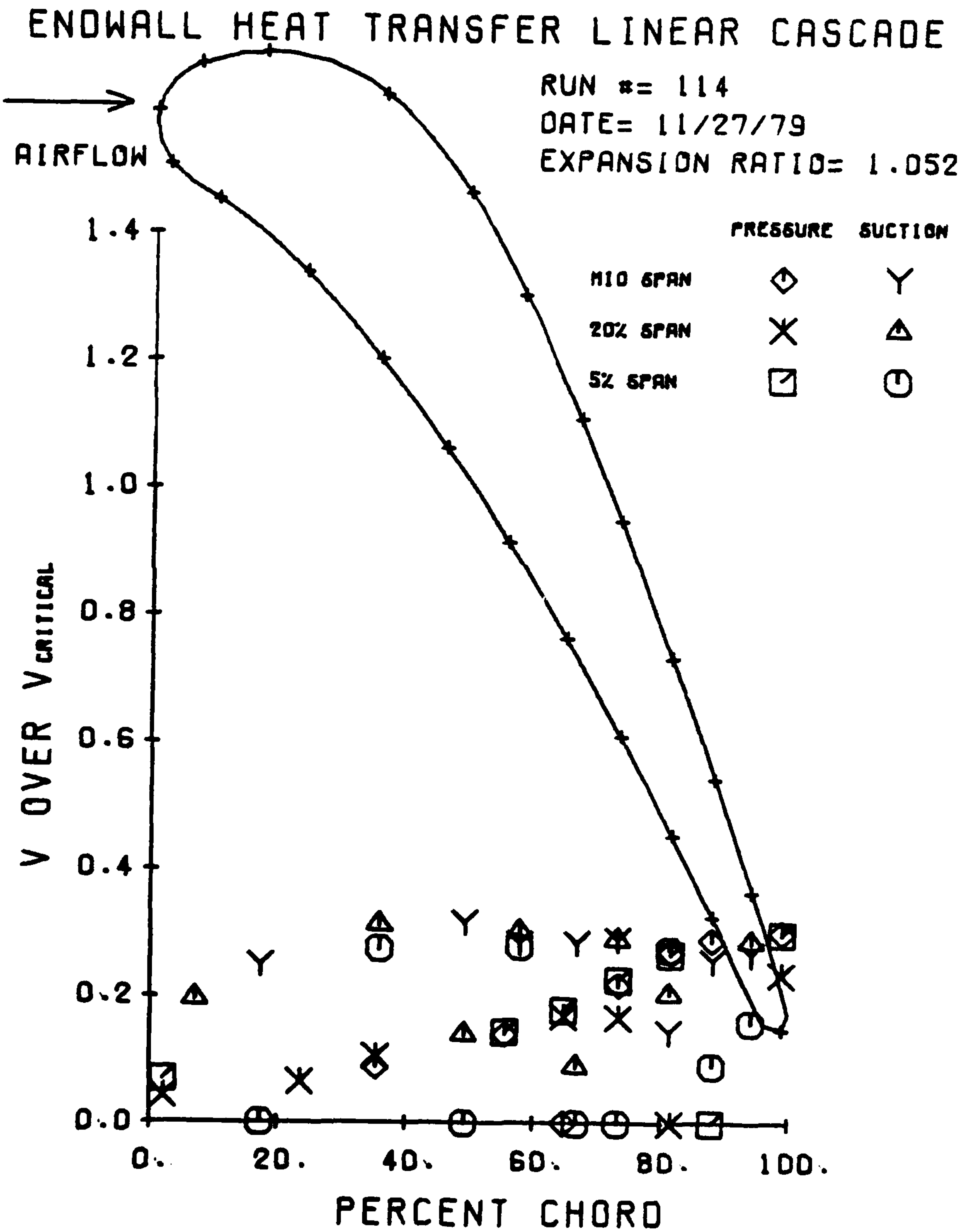
*** LEGEND ***
UNITS = TEMP

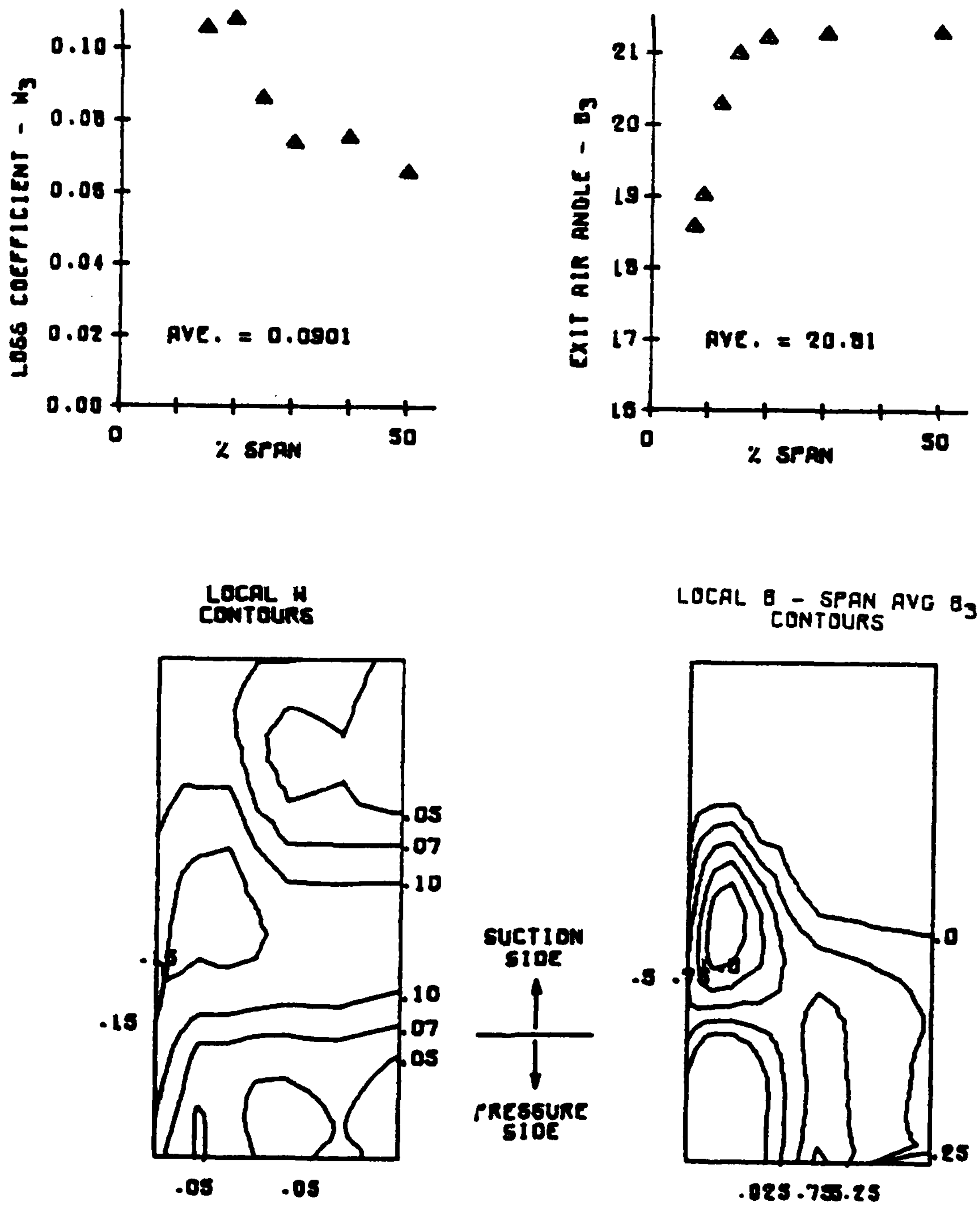
SYMBOL	CONTOUR
A	7.30000E 02
B	7.20000E 02
C	7.10000E 02
D	7.00000E 02
E	6.90000E 02
F	6.80000E 02
G	6.70000E 02
H	6.60000E 02
I	6.50000E 02
J	6.40000E 02
MAX	7.32149E 02
MIN	6.35212E 02

RUN 114 MACH .3 TGAS 800 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:08:58 79/331



RUN 114 MACH .3 TGAS 800 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 18:03:15 80/014


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 114
DATE= 11/27/79
EXPANSION RATIO= 1.052
AIRFLOW
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V OVER V CRITICAL
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.28 REYNOLDS NO. = 2.13×10^5

RUN 114 AERODYNAMIC EXIT DATA

GMA 200 TURBINE VANE CASCADE

RUN #115 DATE: 12/11/79 TIME: 11:49: 7

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
43.41	42.34	1275.32	.192	.208	.405

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
43.41	31.61	1275.32	.697	.726	1.202

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.373 STATIC PRESSURE RATIO= .747

*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.3	1.508	42.95	1211.	.680	18.83	.0394	.0327
44.6	1.509	43.04	1213.	.684	18.72	.0318	.0263
29.5	1.495	43.02	1227.	.682	18.69	.0333	.0275
25.7	1.515	43.00	1204.	.682	18.75	.0353	.0293
20.3	1.533	42.79	1195.	.675	19.12	.0533	.0443
16.4	1.563	42.58	1162.	.669	19.58	.0709	.0591
12.6	1.531	42.52	1165.	.667	19.73	.0766	.0639
9.8	1.565	42.52	1175.	.667	19.62	.0767	.0640
5.6	1.559	42.42	1183.	.665	19.69	.0851	.0711
AVERAGE	1.533	42.80	1200.	.676	19.11	.0527	.0438

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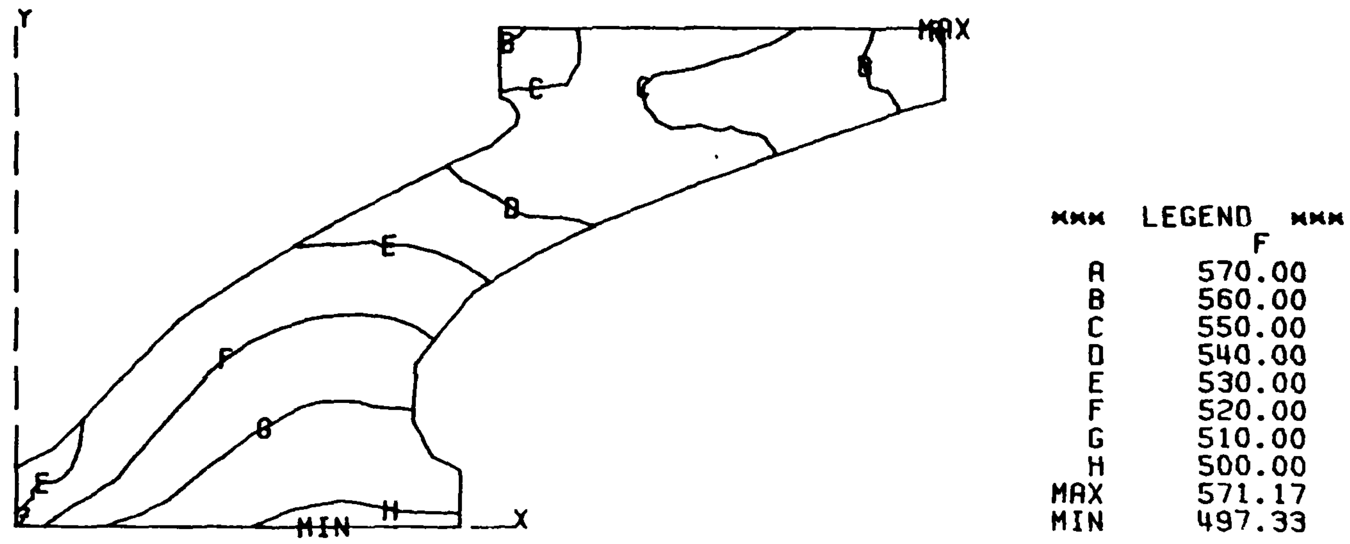
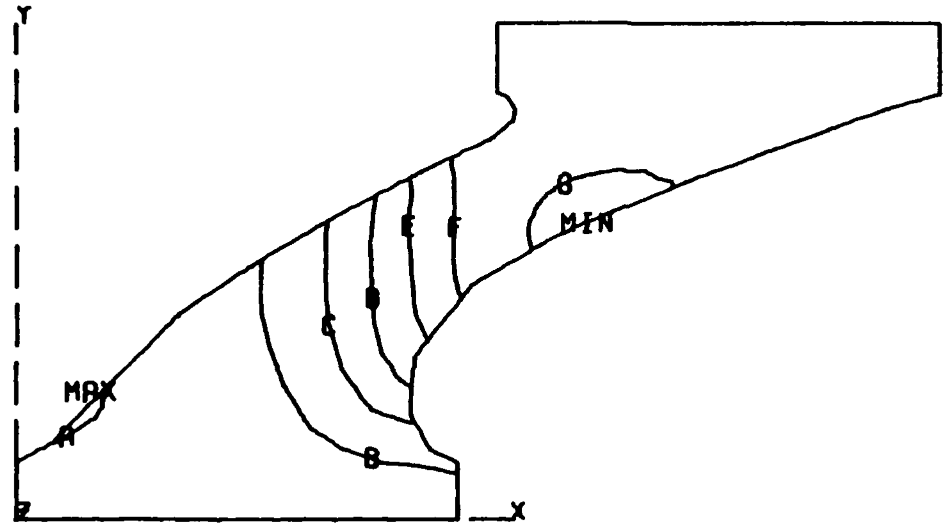
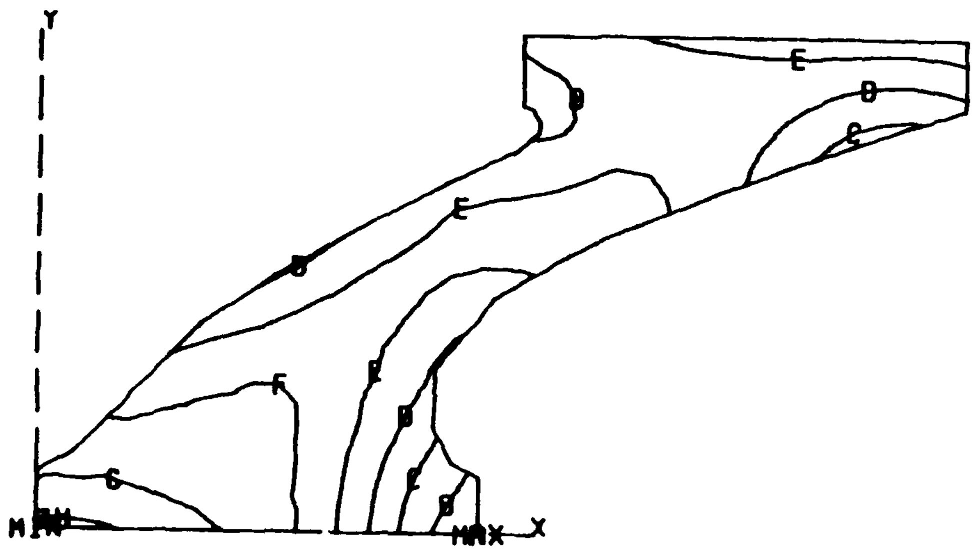


RUN 116 MACH .7 TGAS 800. RE 1.2E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:36:35 80/003



***	LEGEND	***
	PSI	
A	43.00	
B	41.00	
C	39.00	
D	37.00	
E	35.00	
F	33.00	
G	31.00	
MAX	43.04	
MIN	30.39	

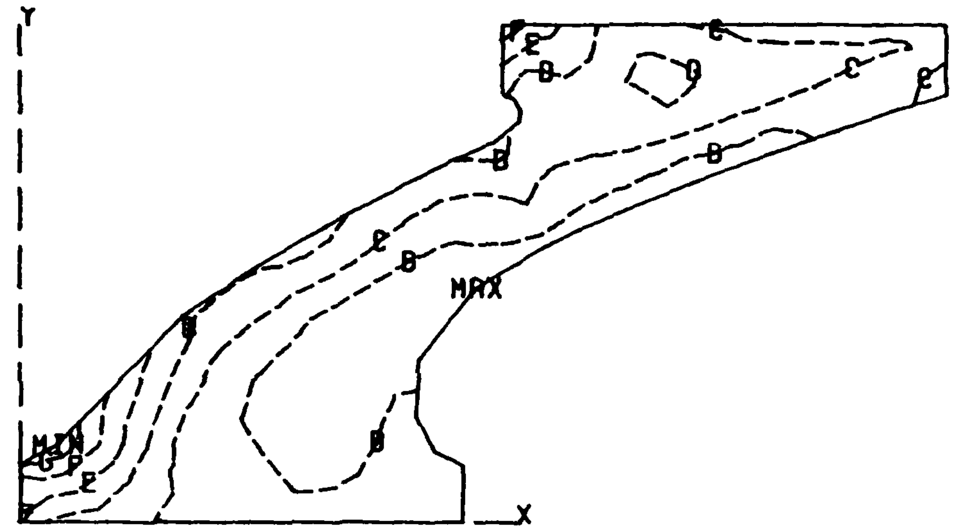
RUN 116 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:41:06 80/176



*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	7.25000E 02
B	7.17000E 02
C	7.09000E 02
D	7.01000E 02
E	6.93000E 02
F	6.85000E 02
G	6.77000E 02
H	6.69000E 02
MAX	7.25496E 02
MIN	6.66625E 02

RUN 116 MACH .7 TGAS 800. RE 1.2E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:47:44 79/347

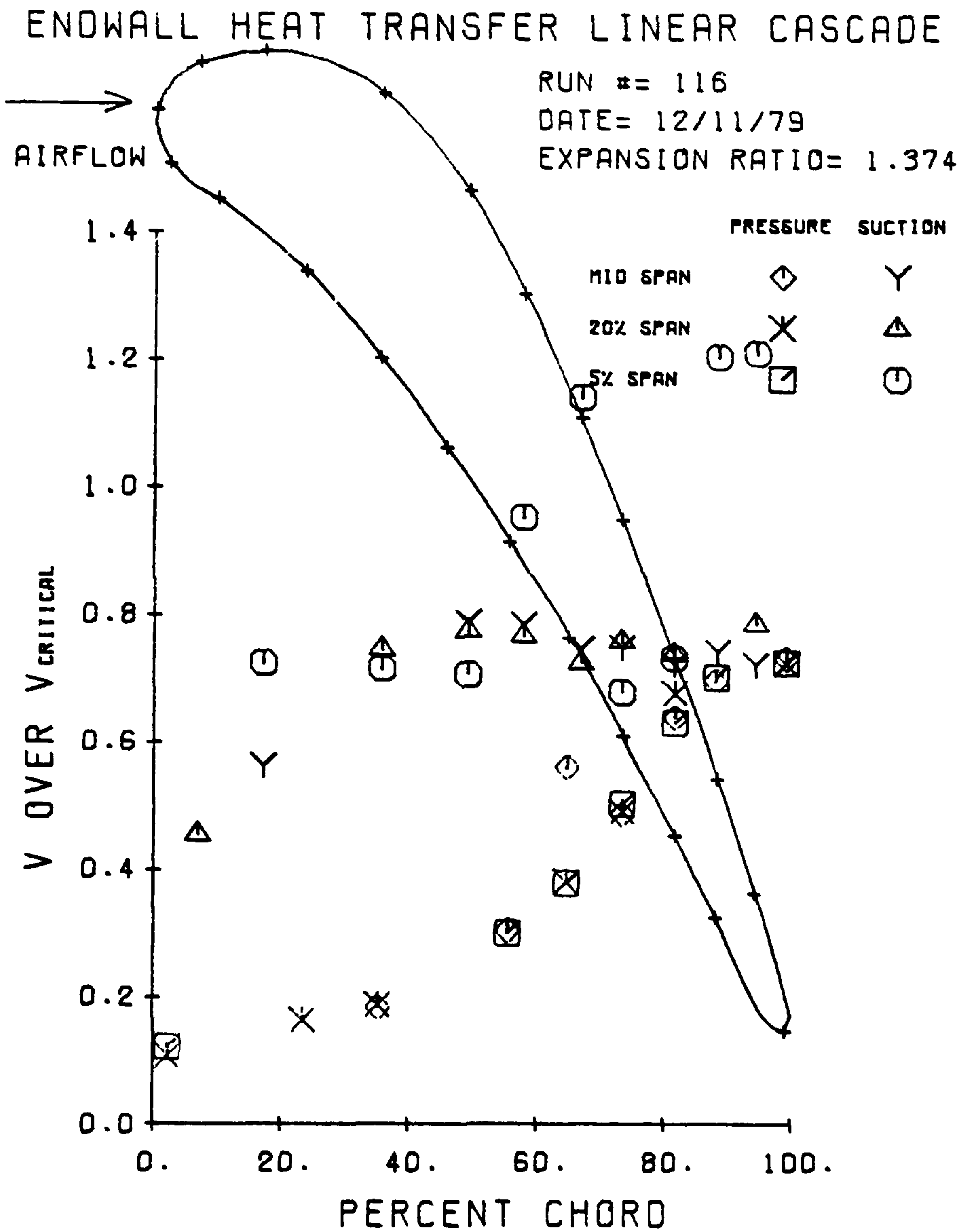


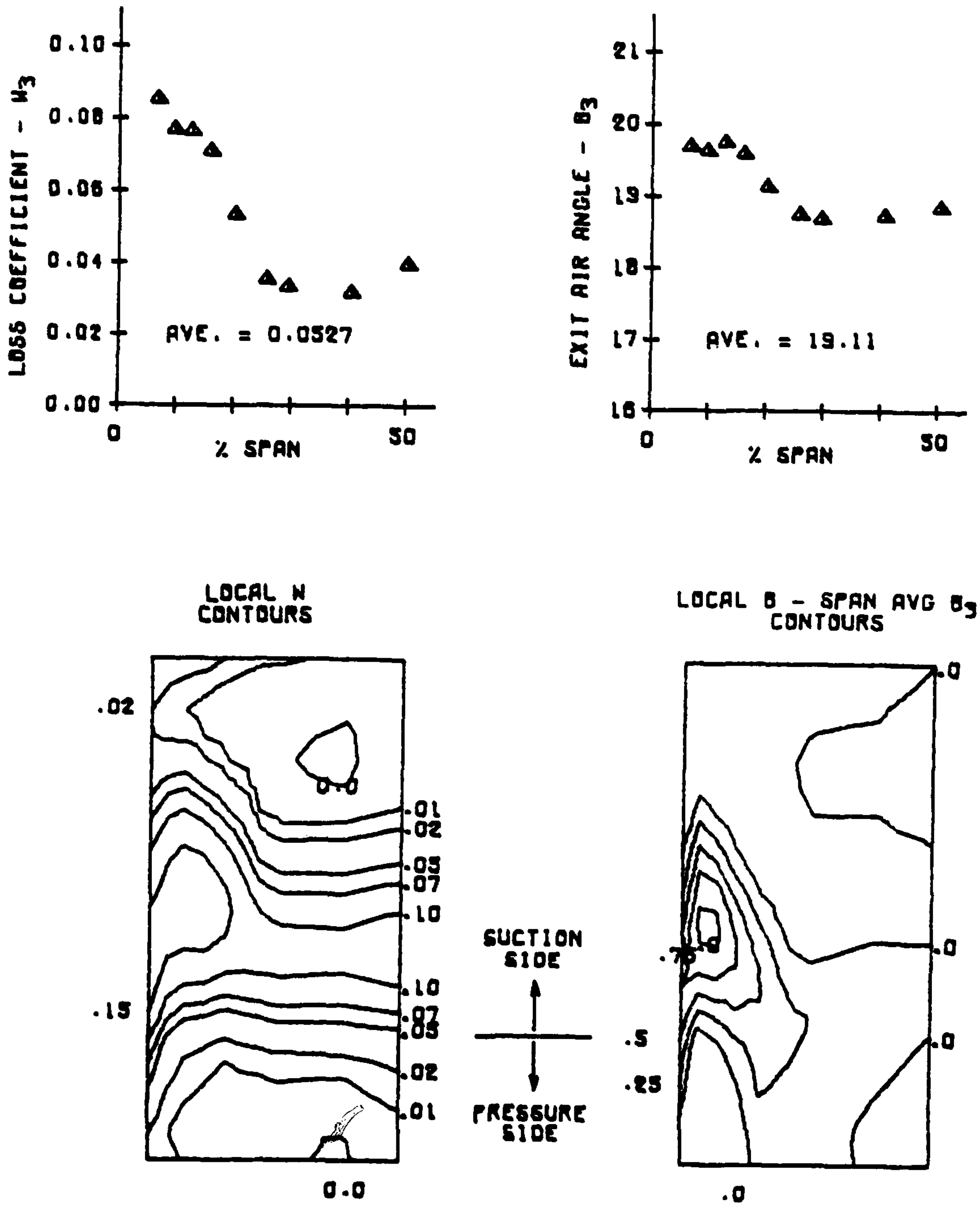
*** LEGEND ***

	F (E-06)
A	-2200.00
B	-3000.00
C	-3800.00
D	-4600.00
E	-5400.00
F	-6200.00
G	-6999.99
MAX	-2208.44
MIN	-7686.63

RUN 116 MACH .7 TGAS 800. RE 1.2E06 HEAT TRANSFER ENDWALL
:ONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 12:39:52 80/003


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 116
DATE= 12/11/79
EXPANSION RATIO= 1.374
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD

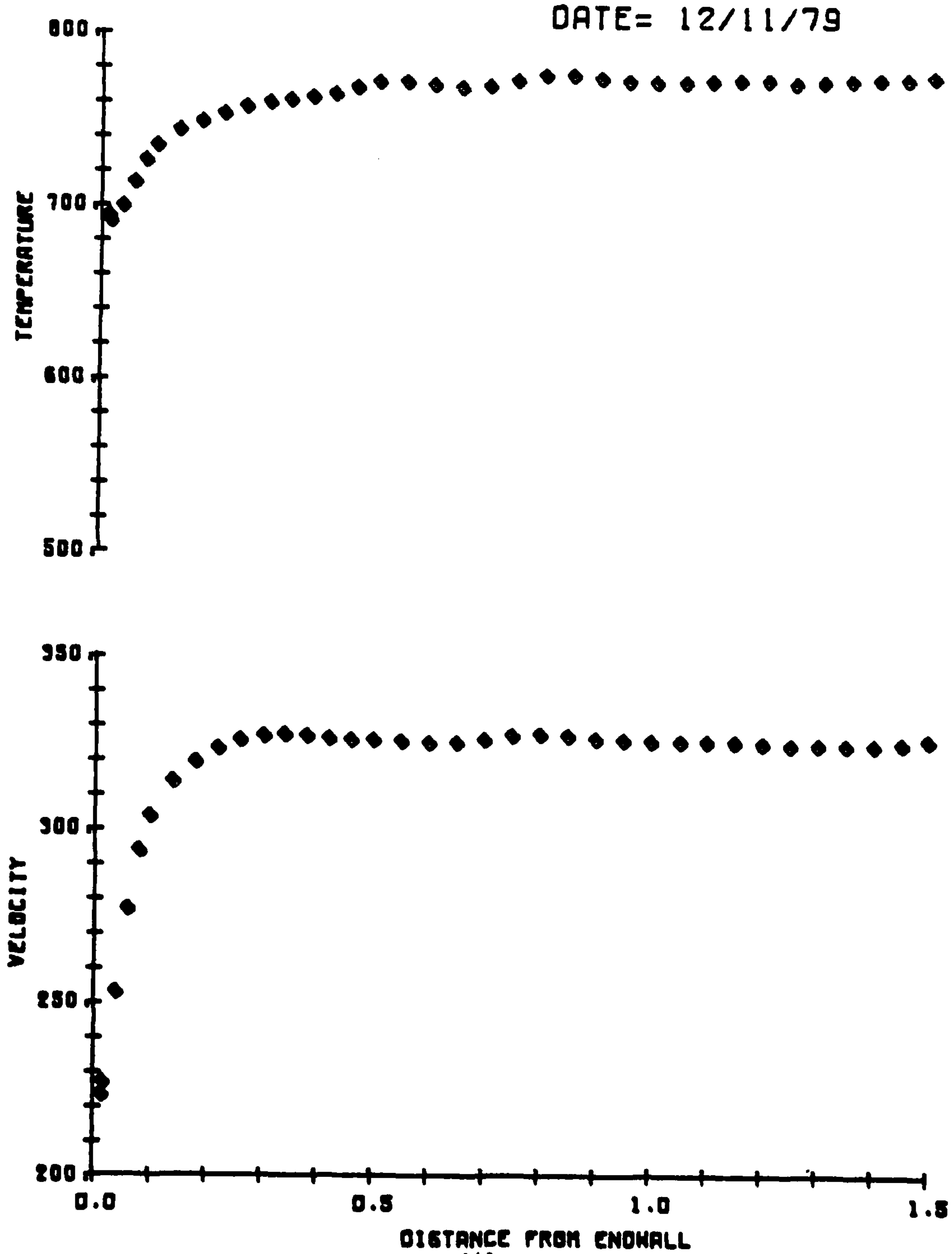


EXIT MACH NO. = 0.70 REYNOLDS NO. = 1.20 X 10^6

RUN 116 AERODYNAMIC EXIT DATA

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 116
DATE= 12/11/79



GMA 220 TURBINE VANE CASCADE

RUN #116 DATE: 12/13/79 TIME: 7: 8:19

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
34.34	33.58	1244.41	.180	.196	.311

STANTON CALCULATION INPUT

RHO =LBM/IN3 *10**4	VELOCITY = IN/HR	STREAM TEMPERATURE = F
.42418	13430438.	777.40

CP = BTU/LBM/F
.256

MASS FLOW RATE

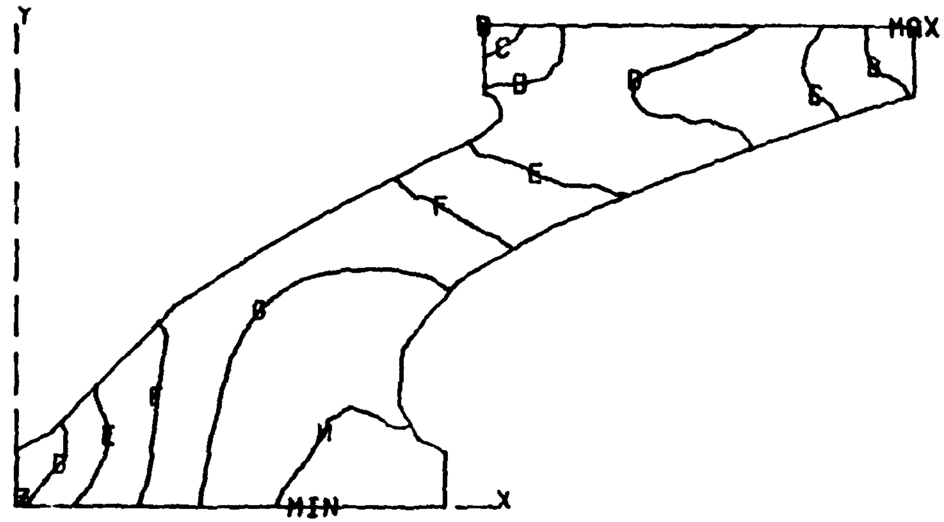
ORIFICE 5.55 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
34.34	25.30	1244.41	.683	.713	.967

CASCADE OPERATING CONDITION

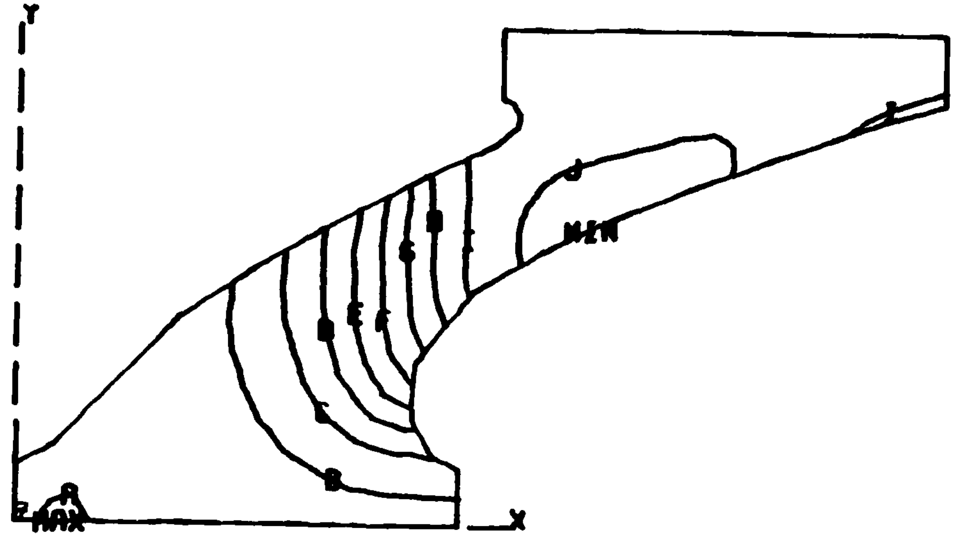
EXPANSION RATIO= 1.357 STATIC PRESSURE RATIO= .753



*** LEGEND ***
UNITS = TEMP

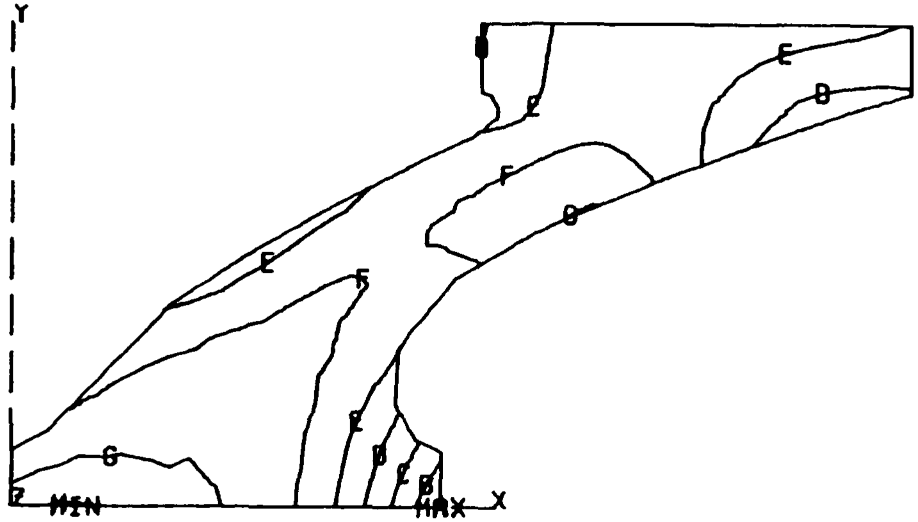
SYMBOL	CONTOUR
A	5.50000E 02
B	5.42000E 02
C	5.34000E 02
D	5.26000E 02
E	5.18000E 02
F	5.10000E 02
G	5.02000E 02
H	4.94000E 02
MAX	5.50027E 02
MIN	4.92130E 02

RUN 118 MACH .7 TGAS 800 RE 1.0E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 19:06:13 79/347



*** LEGEND ***	PSI
A	34.00
B	33.00
C	32.00
D	31.00
E	30.00
F	29.00
G	28.00
H	27.00
I	26.00
J	25.00
MAX	34.03
MIN	24.34

RUN 118 MACH=.7 TGAS=800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:54:51 80/212

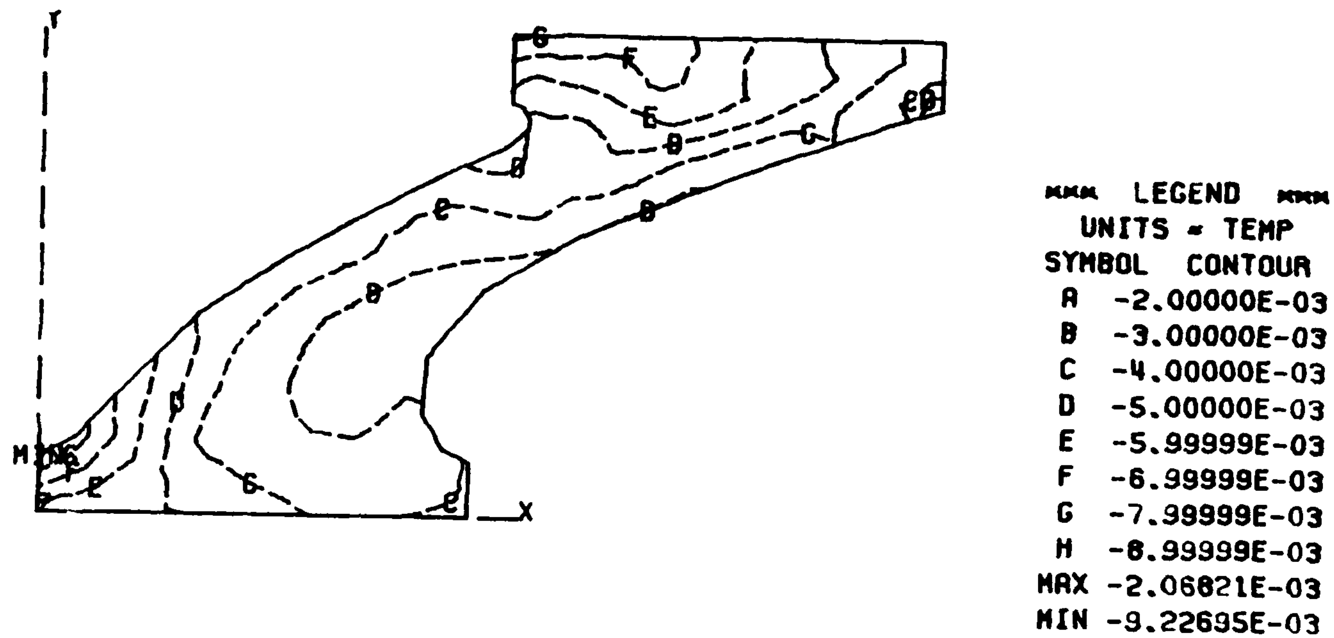


*** LEGEND ***

UNITS = TEMP

SYMBOL	CONTOUR
A	7.24000E 02
B	7.16000E 02
C	7.08000E 02
D	7.00000E 02
E	6.92000E 02
F	6.84000E 02
G	6.76000E 02
H	6.68000E 02
MAX	7.24468E 02
MIN	6.67099E 02

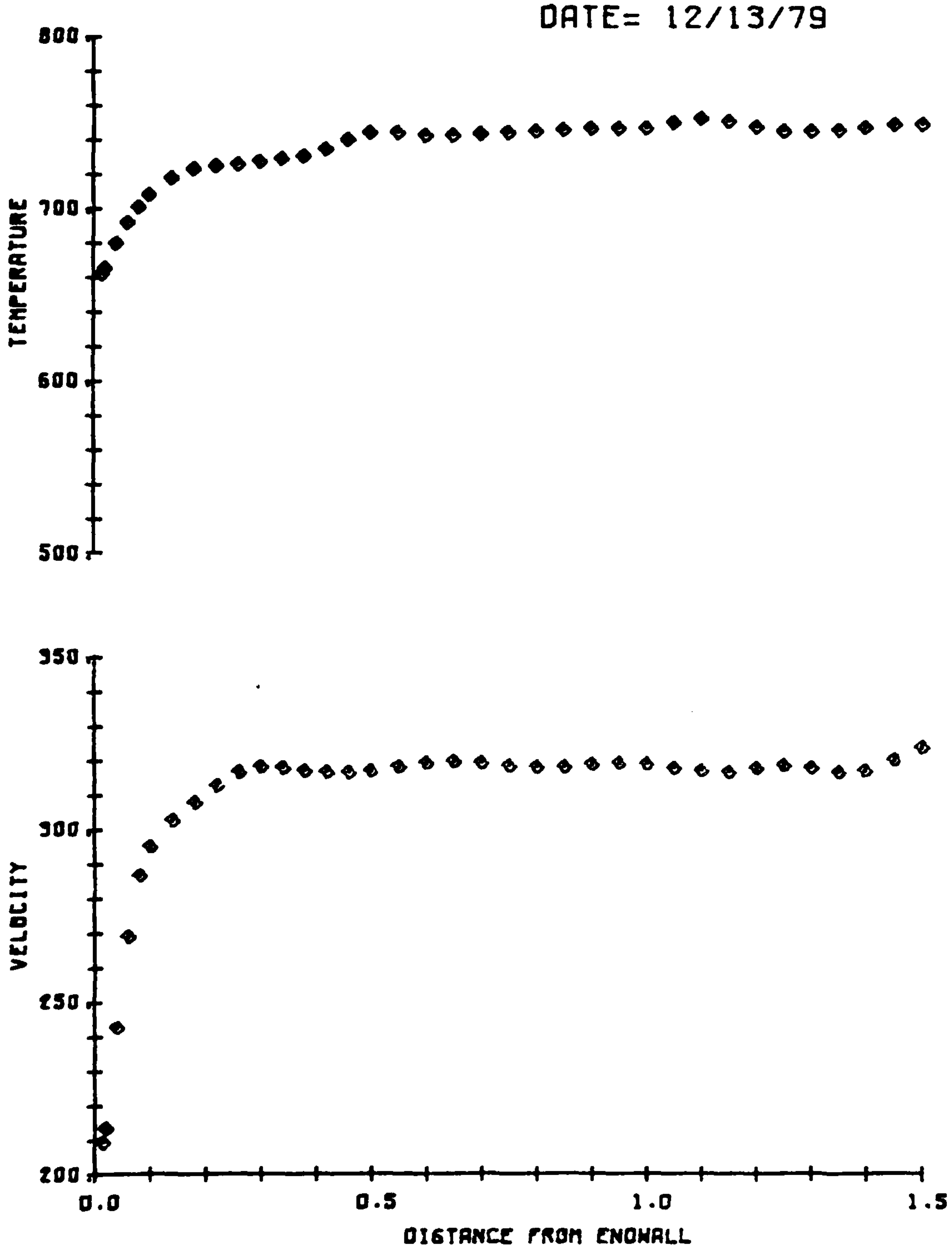
RUN 118 MACH .7 TGAS 800 RE 1.0E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:22:27 79/347



RUN 118 MACH .7 TGAS 800 RE 1.0E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 19:06:56 79/347

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 118
DATE= 12/13/79



GNA 204 TURBINE VANE CASCADE

RUN #122 DATE: 01/07/80 TIME: 7:30:41

INLET CONDITIONS

PTOTAL	PSTATIC	TTOTAL	MACH #	V/V*	REY/10**6
59.61	56.42	1228.85	.186	.202	.566

IDEAL EXIT CONDITIONS

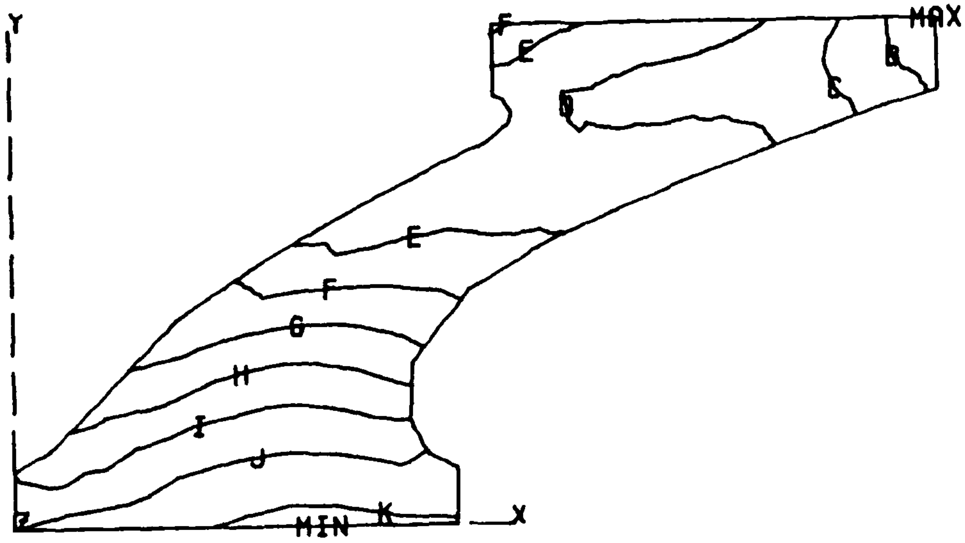
PTOTAL	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
59.61	43.12	1228.85	.708	.737	1.745

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.367 STATIC PRESSURE RATIO= .738

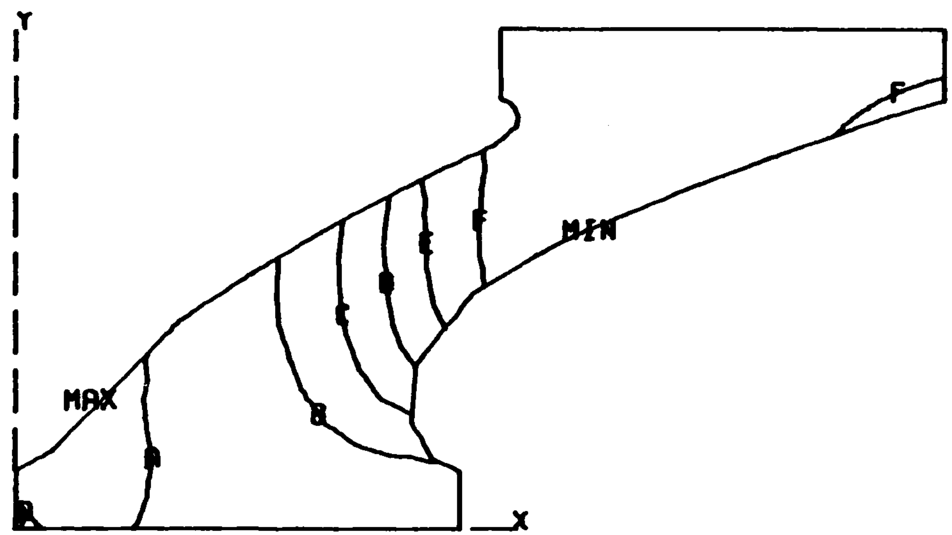
*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
49.9	2.092	59.12	1217.	.689	18.90	.0417	.0344
40.4	1.931	59.15	1226.	.689	17.42	.0399	.0329
29.9	2.130	59.14	1206.	.690	19.12	.0410	.0338
25.0	1.942	59.05	1211.	.687	17.51	.0461	.0380
19.9	1.973	58.62	1201.	.681	17.56	.0677	.0503
14.9	2.112	58.46	1192.	.674	19.29	.0822	.0684
11.0	2.032	58.44	1175.	.673	18.44	.0836	.0695
8.9	2.036	58.42	1162.	.672	18.37	.0846	.0776
7.3	1.927	58.37	1164.	.671	17.54	.0879	.0732
AVERAGE	2.0[illegible]7	58.85	1202.	.682	18.15	.0587	.0487



*** LEGEND ***	F
A	640.00
B	630.00
C	620.00
D	610.00
E	600.00
F	590.00
G	580.00
H	570.00
I	560.00
J	550.00
K	540.00
MAX	640.06
MIN	536.41

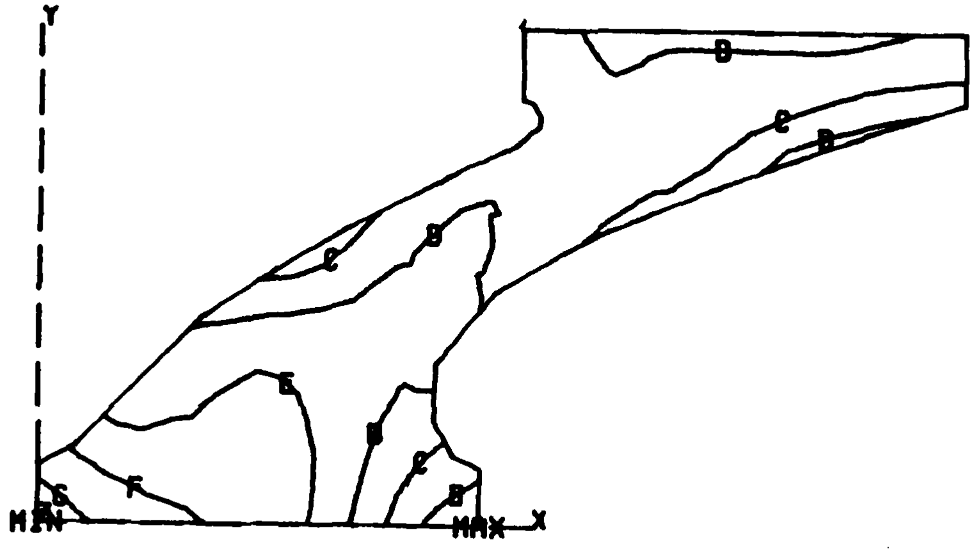
RUN 122 MACH .7 TGAS 800 RE 1.7E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 14:20:48 80/011



*** LEGEND ***

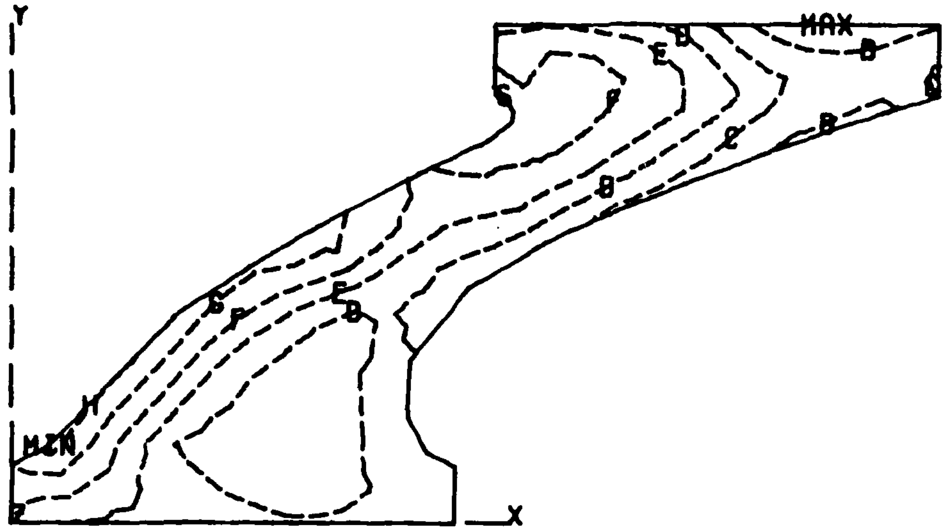
	PSI
A	59.00
B	56.00
C	53.00
D	50.00
E	47.00
F	44.00
MAX	59.40
MIN	41.31

RUN 122 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:01:56 80/162



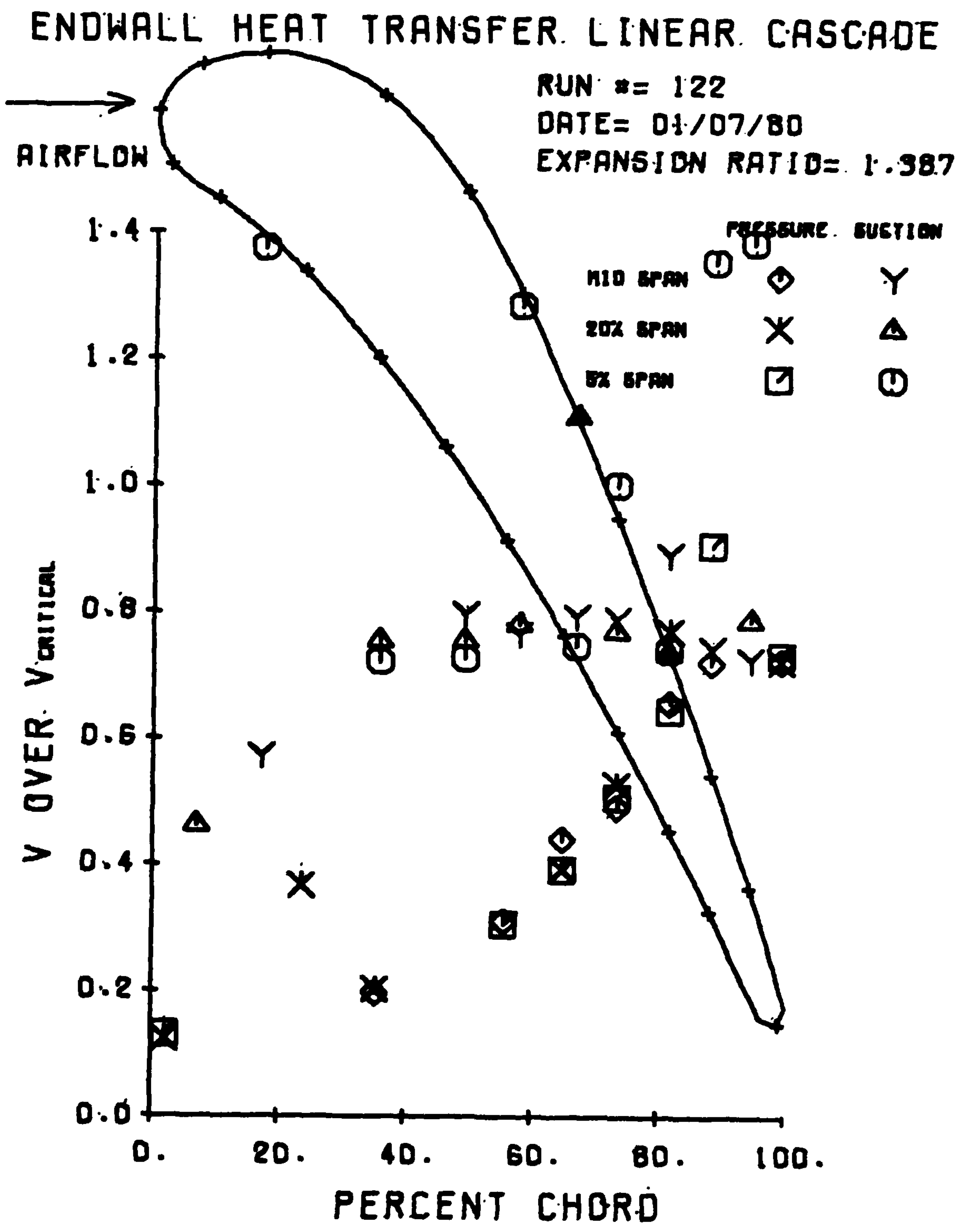
*** LEGEND ***	F
A	743.00
B	735.00
C	727.00
D	719.00
E	711.00
F	703.00
G	695.00
MAX	743.02
MIN	688.28

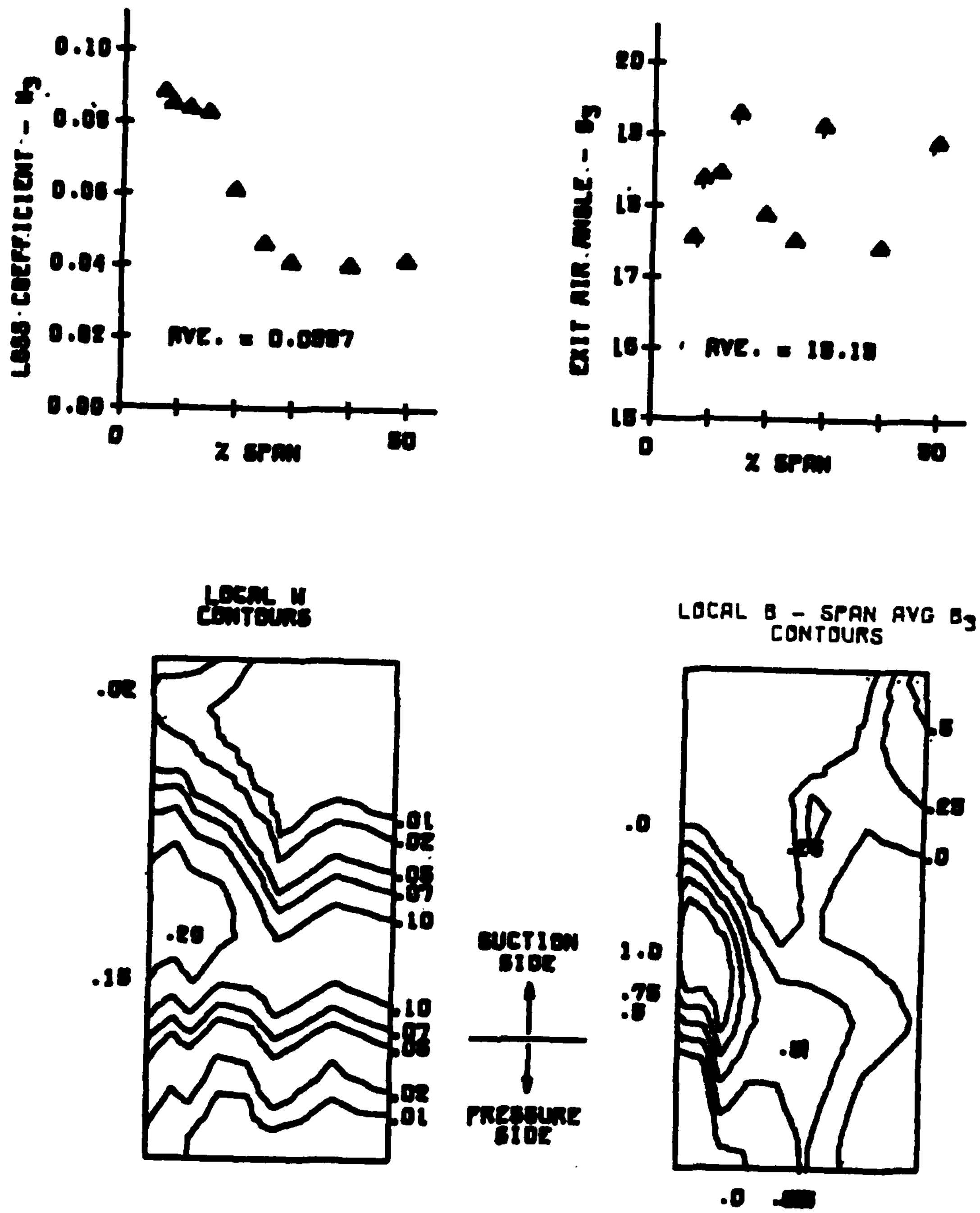
RUN 122 MACH .7 TGAS 800 RE 1.7E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 11:30:59 80/007



*** LEGEND ***	F (E-06)
A	-800.00
B	-1600.00
C	-2400.00
D	-3200.00
E	-4000.00
F	-4800.00
G	-5600.00
H	-6400.00
MAX	-812.80
MIN	-6714.18

RUN 122 MACH .7 TGAS 800 RE 1.7E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 14:21:43 80/011


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 122
DATE= 01/07/80
EXPANSION RATIO= 1.387
AIRFLOW
PRESSURE SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD

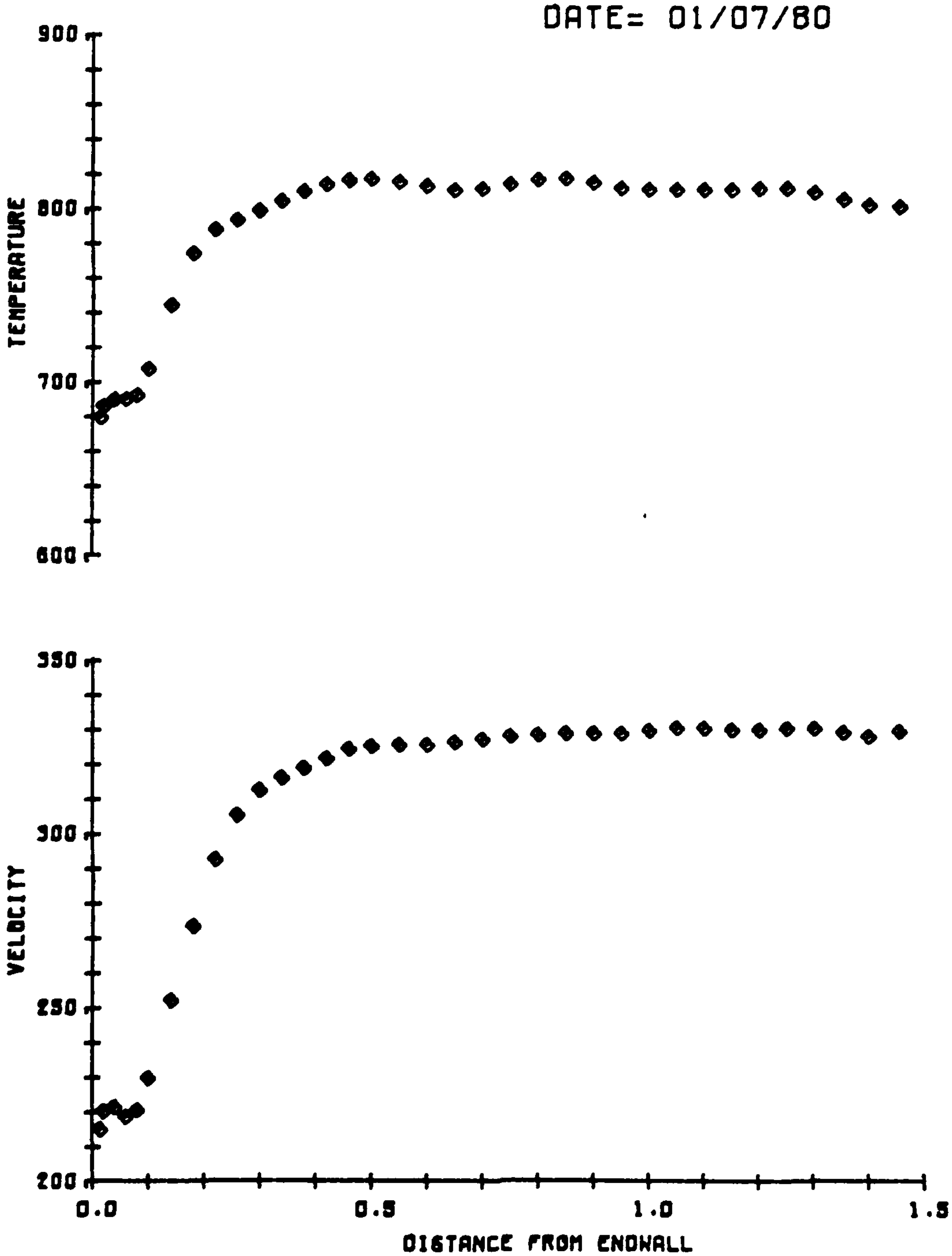


EXIT MACH.NO. = 0.71 REYNOLDS NO. = 1.74 X 10[6]

RUN 122 AERODYNAMIC EXIT DATA

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 122
DATE= 01/07/80



GMA 200 TURBINE VANE CASCADE

RUN #123 DATE: 01/07/80 TIME: 8:47:15

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
31.99	31.26	1229.75	.183	.199	.298

IDEAL EXIT CONDITIONS

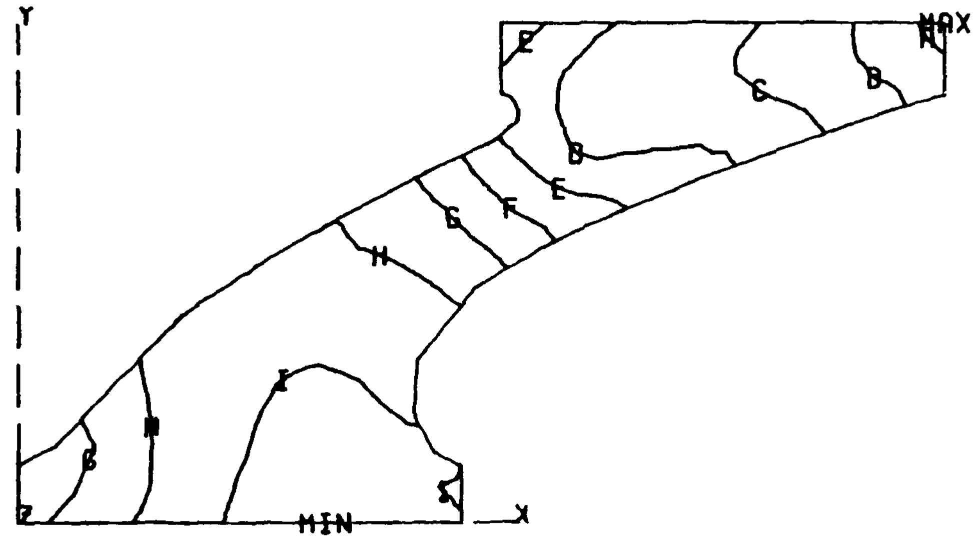
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
31.99	23.49	1229.75	.687	.717	.916

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.362 STATIC PRESSURE RATIO= .751

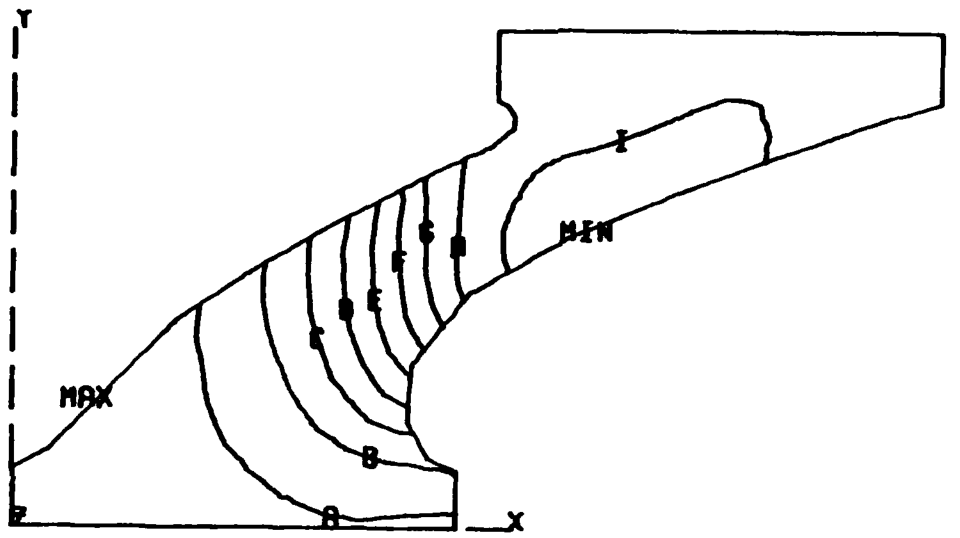
*** MIXED OUT CONDITION SUMMARY ***

% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
49.9	1.182	31.68	1212.	.669	20.20	.0368	.0307
40.0	1.063	31.67	1198.	.668	18.01	.0374	.0312
30.0	1.167	31.57	1217.	.669	19.99	.0377	.0314
25.0	1.111	31.64	1207.	.667	18.94	.0409	.0341
20.0	1.109	31.51	1200.	.663	18.99	.0567	.0474
14.9	1.200	31.35	1199.	.659	20.79	.0758	.0635
11.9	1.165	31.31	1191.	.658	20.50	.0798	.0669
9.9	1.155	31.27	1208.	.656	20.19	.0847	.0712
7.3	1.070	31.22	1204.	.654	18.65	.0907	.0762
AVERAGE	1.124	31.51	1205.	.664	19.34	.0562	.0470



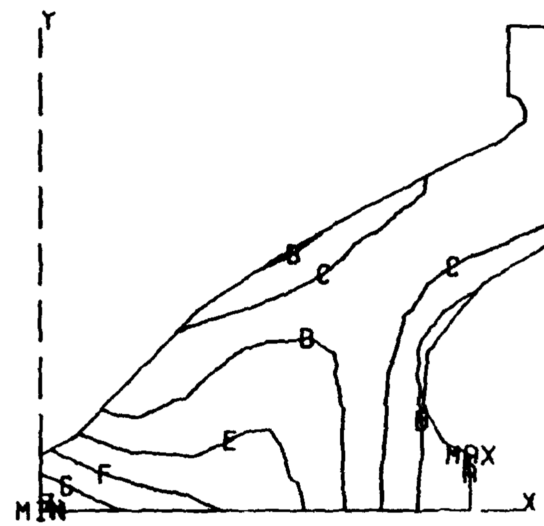
***	LEGEND *** F
A	590.00
B	580.00
C	570.00
D	560.00
E	550.00
F	540.00
G	530.00
H	520.00
I	510.00
MAX	593.49
MIN	504.09

RUN 123 MACH .7 TGr . 800 RE .9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 11:09:44 80/014



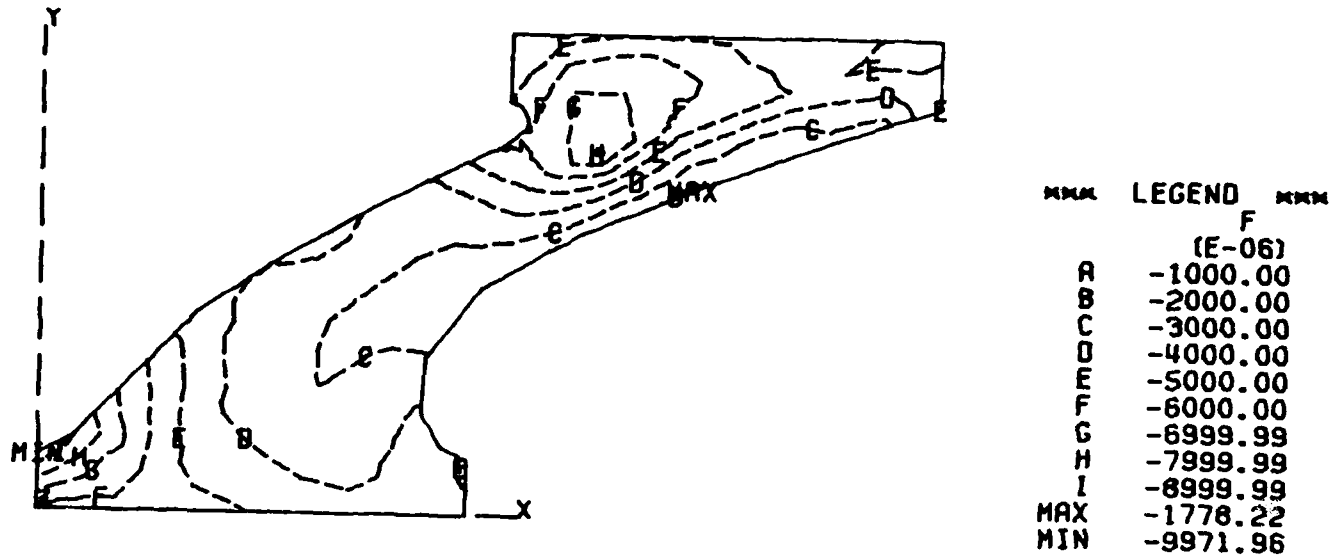
*** LEGEND ***	PSI
A	31.00
B	30.00
C	29.00
D	28.00
E	27.00
F	26.00
G	25.00
H	24.00
I	23.00
MAX	31.61
MIN	22.18

RUN 123 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:09:06 80/162

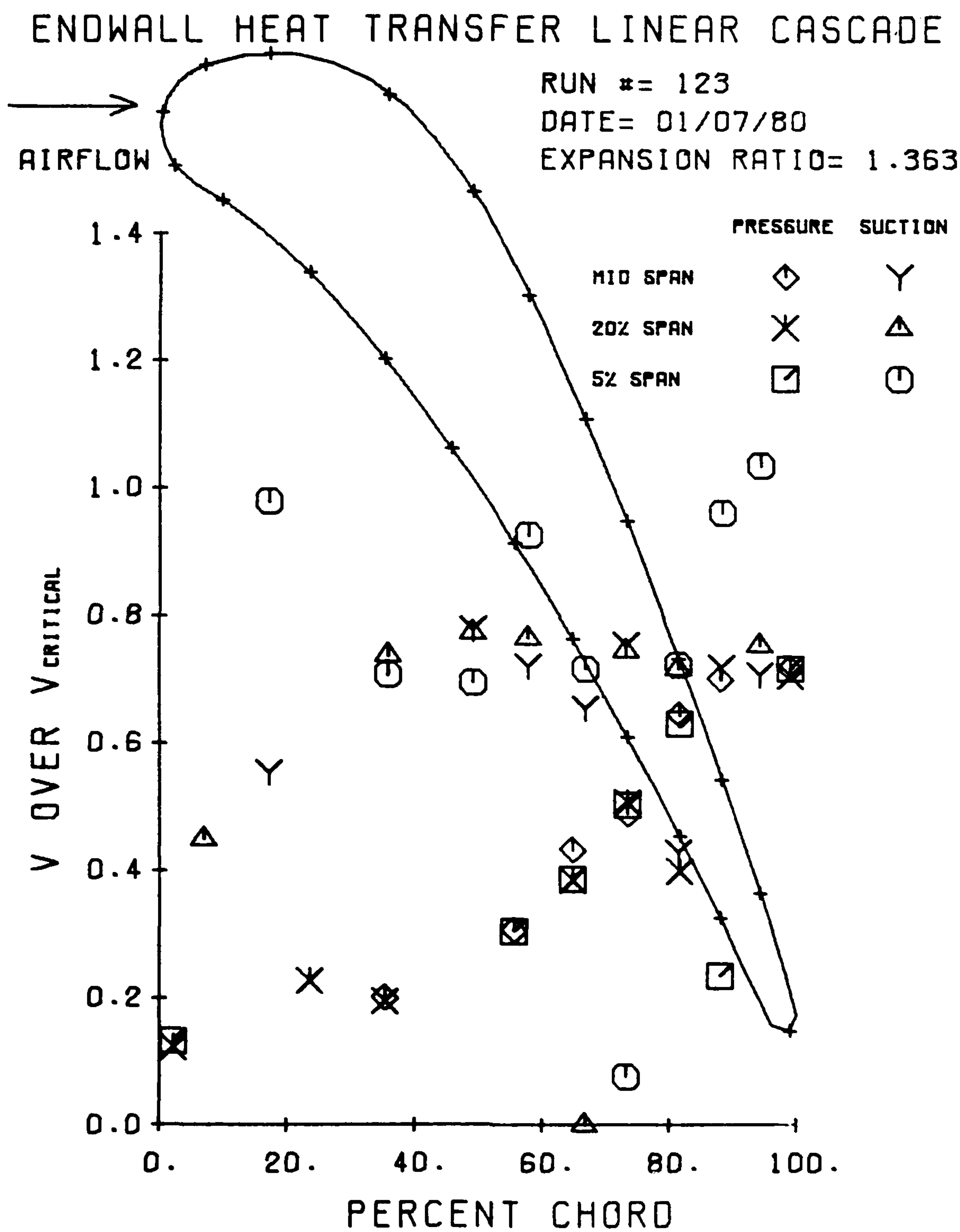


*** LEGEND ***	F
A	743.00
B	737.00
C	731.00
D	725.00
E	719.00
F	713.00
G	707.00
H	701.00
MAX	743.48
MIN	698.40

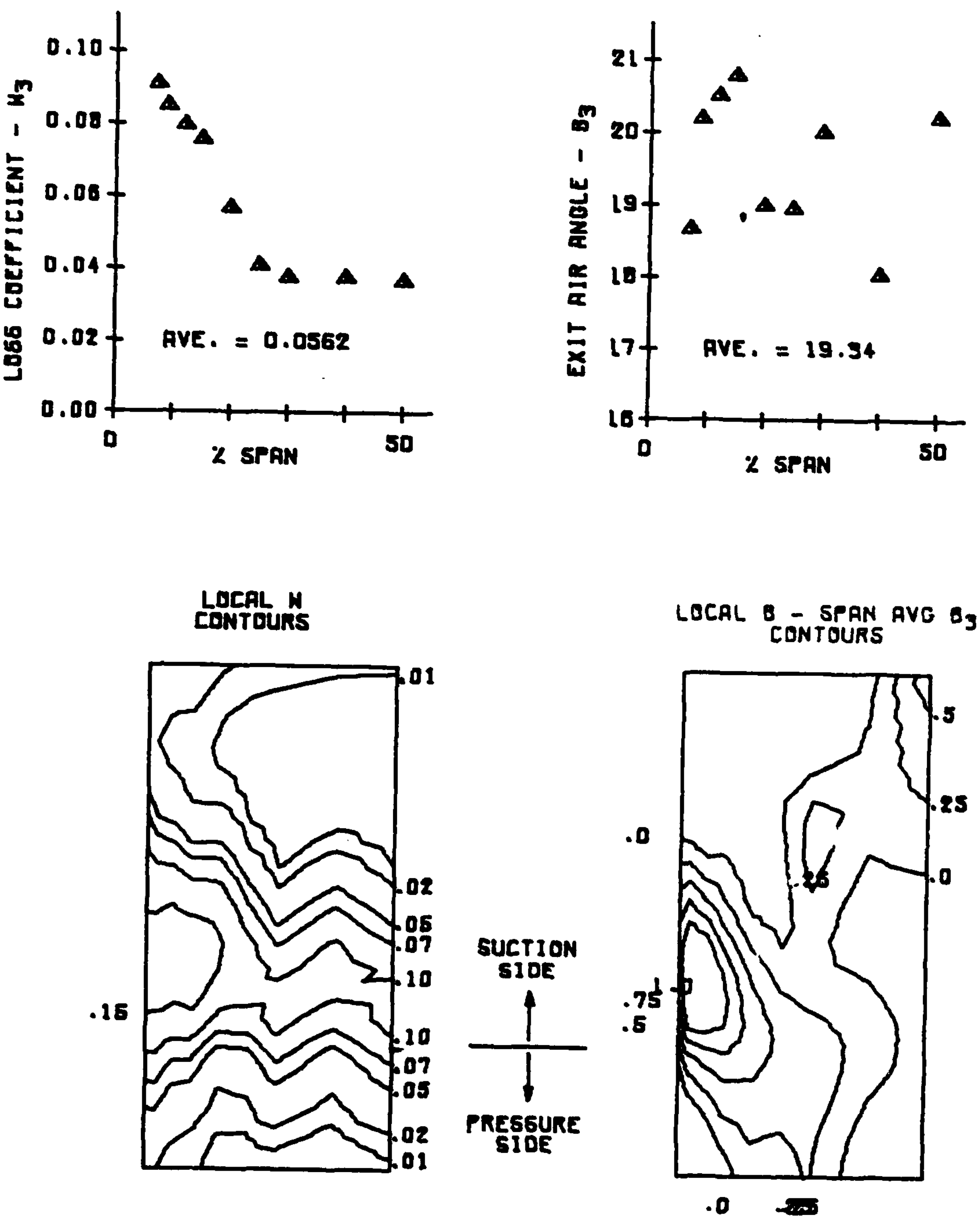
RUN 123 MACH .7 TGAS 800 RE .9E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 9:03:54 80/014



RUN 123 MACH .7 TGAS 800 RE .9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER,
SCALE = 1.0000 PLOT TIME AND DATE = 11:10:51 80/014



ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 123
DATE= 01/07/80
EXPANSION RATIO= 1.363
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V OVER $V_{CRITICAL}$
0.
20.
40.
60.
80.
100.
PERCENT CHORD



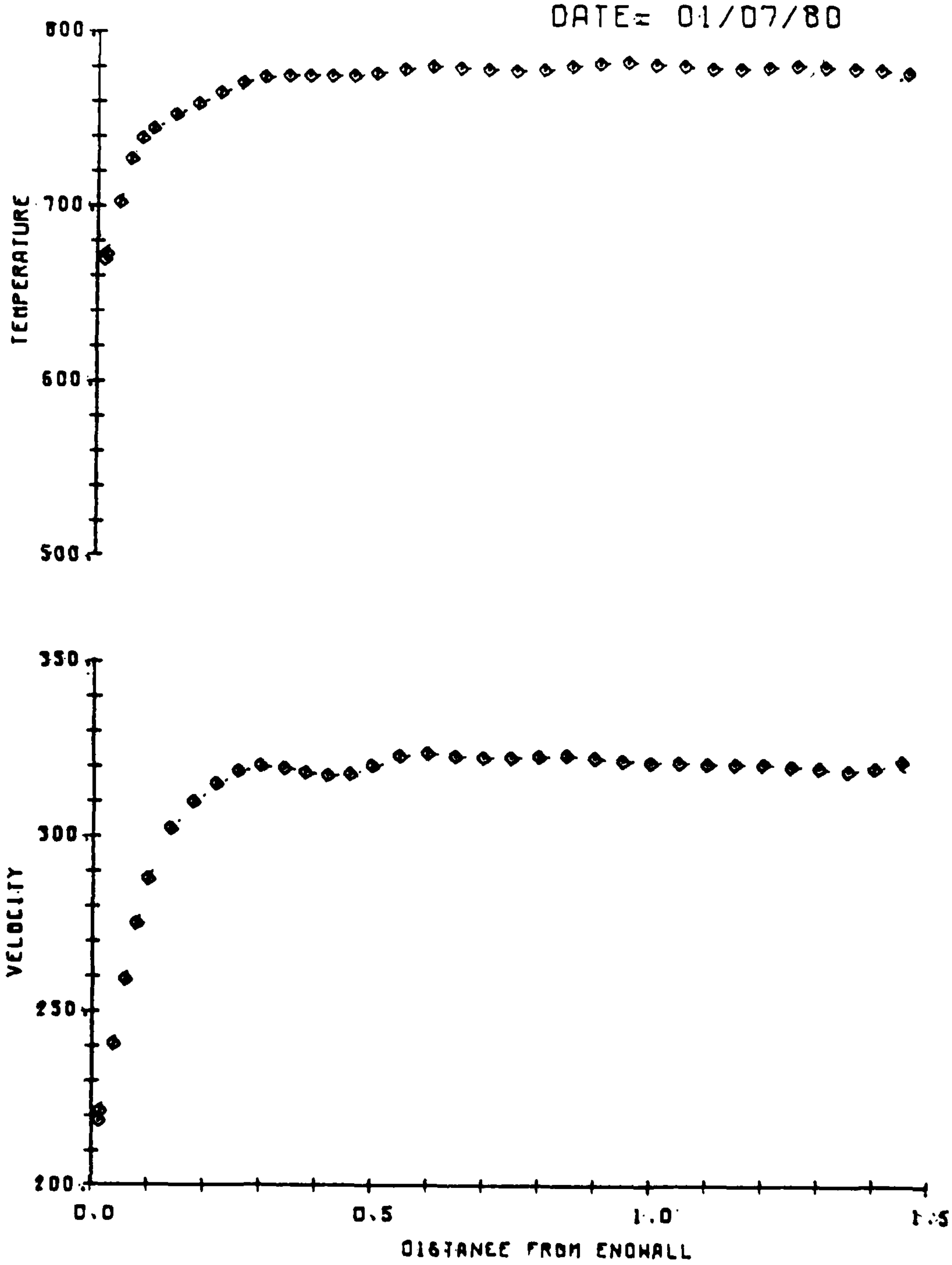
EXIT MACH NO. = 0.69 REYNOLDS NO. = 9.16 X 10^5

RUN 123 AERODYNAMIC EXIT DATA

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 123

DATE= 01/07/80



GMA 200 TURBINE VANE CASCADE

RUN #124 DATE: 01/07/80 TIME: 14:38:52

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
37.35	36.99	1345.54	.120	.130	.208

IDEAL EXIT CONDITIONS

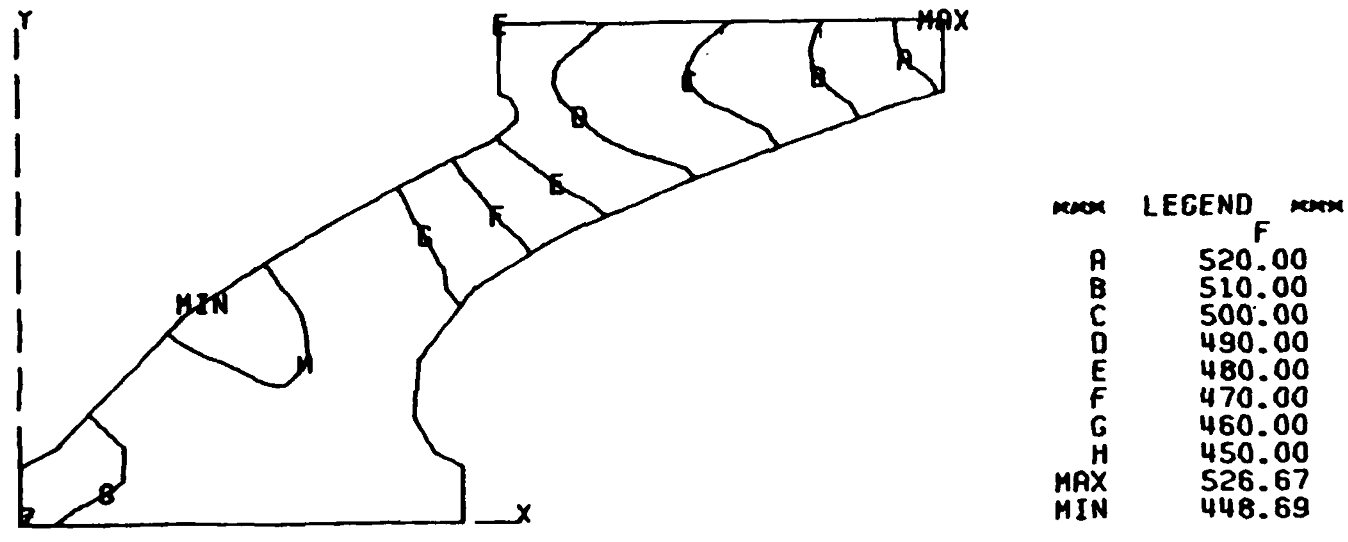
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
37.35	35.11	1345.54	.303	.327	.525

CASCADE OPERATING CONDITION

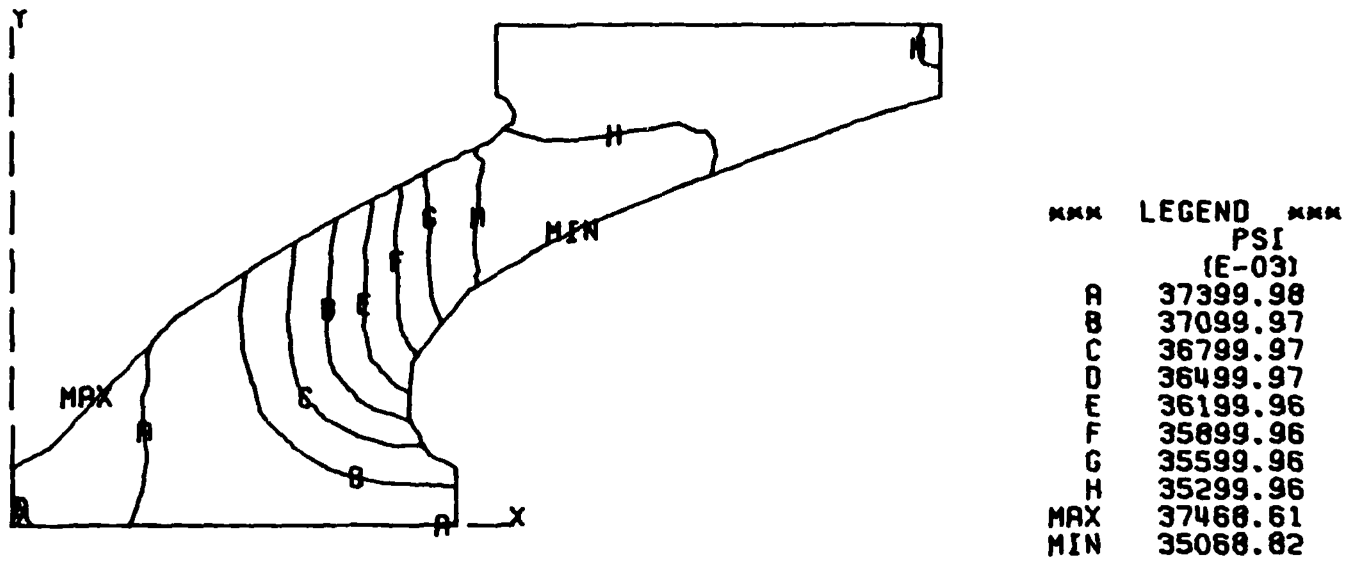
EXPANSION RATIO= 1.064 STATIC PRESSURE RATIO= .949

*** MIXED OUT CONDITION SUMMARY ***

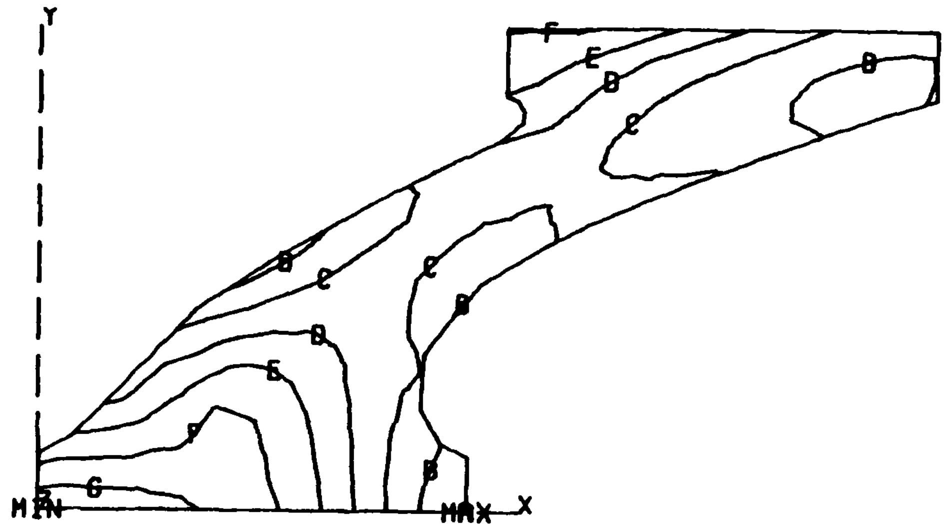
% SPAN	MASS	PT3	TT3	M3	BETA3	OMEGA	EBAR
50.0	.767	37.31	1329.	.290	22.72	.0221	.0214
40.0	.731	37.31	1344.	.259	21.16	.0234	.0226
30.0	.735	37.30	1327.	.288	21.28	.0272	.0262
25.0	.710	37.28	1357.	.267	20.78	.0350	.0338
19.9	.733	37.24	1355.	.287	21.54	.0527	.0509
15.0	.744	37.20	1340.	.283	22.01	.0711	.0687
11.9	.735	37.21	1348.	.261	21.95	.0742	.0679
6.9	.713	37.21	1357.	.284	21.36	.0692	.0669
AVERAGE	.733	37.25	1345.	.266	21.50	.0439	.0424



RUN 124 MACH.3 TGAS 800 RE .56E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 18:19:25 80/014

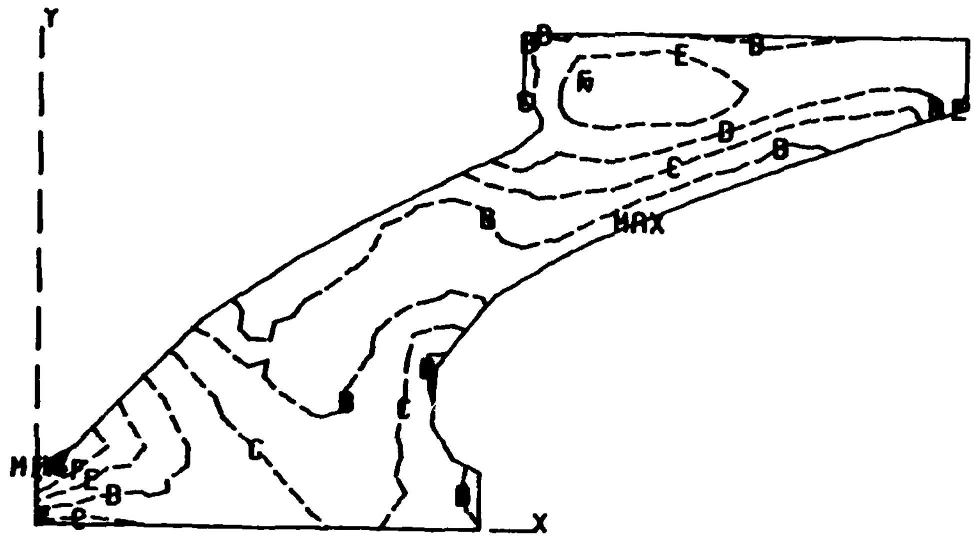


RUN 124 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:38:14 80/162



*** LEGEND ***	F
A	752.00
B	744.00
C	736.00
D	728.00
E	720.00
F	712.00
G	704.00
MAX	752.36
MIN	697.22

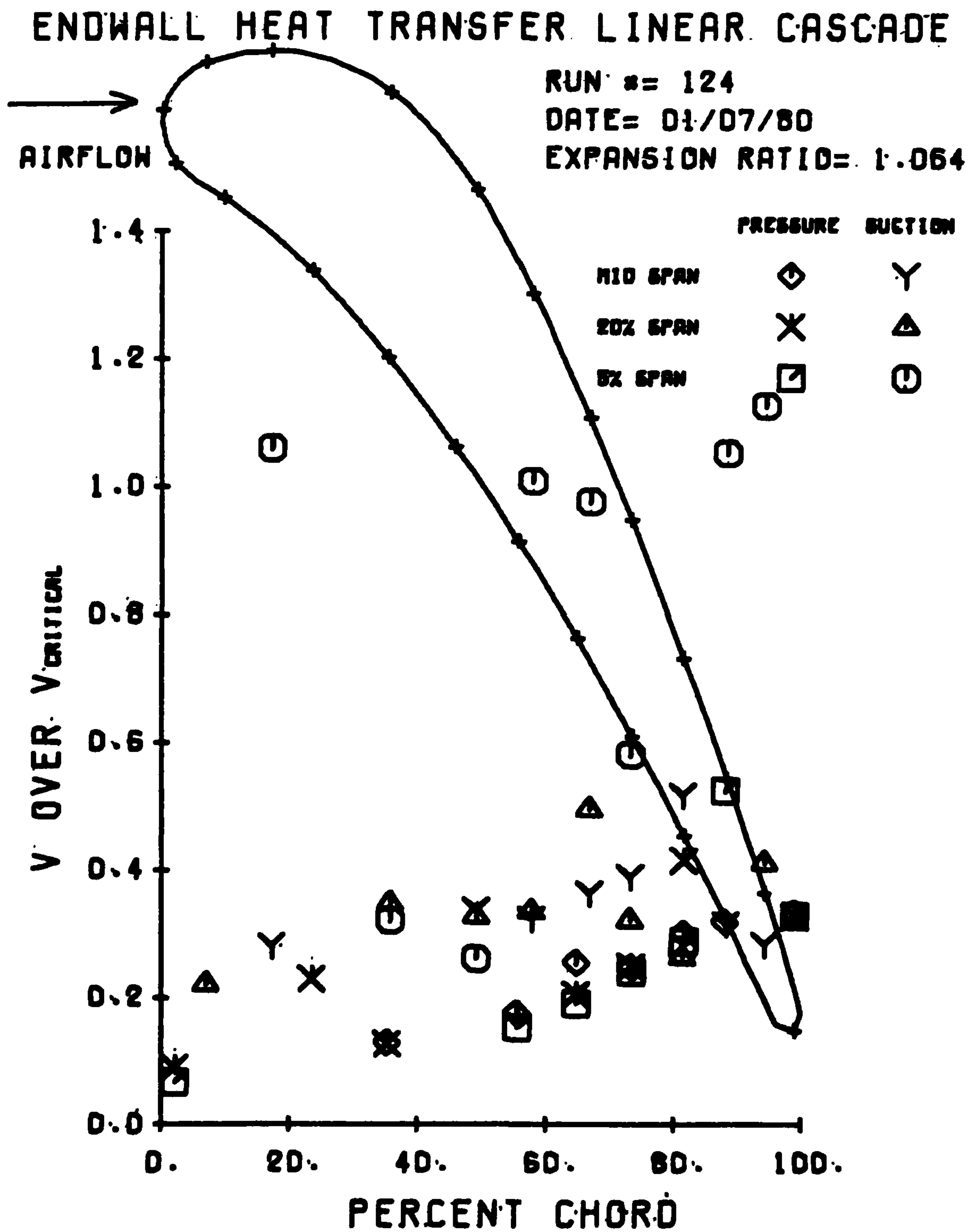
RUN 124 MACH.3 TGAS 800 RE .56E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:20:49 80/014

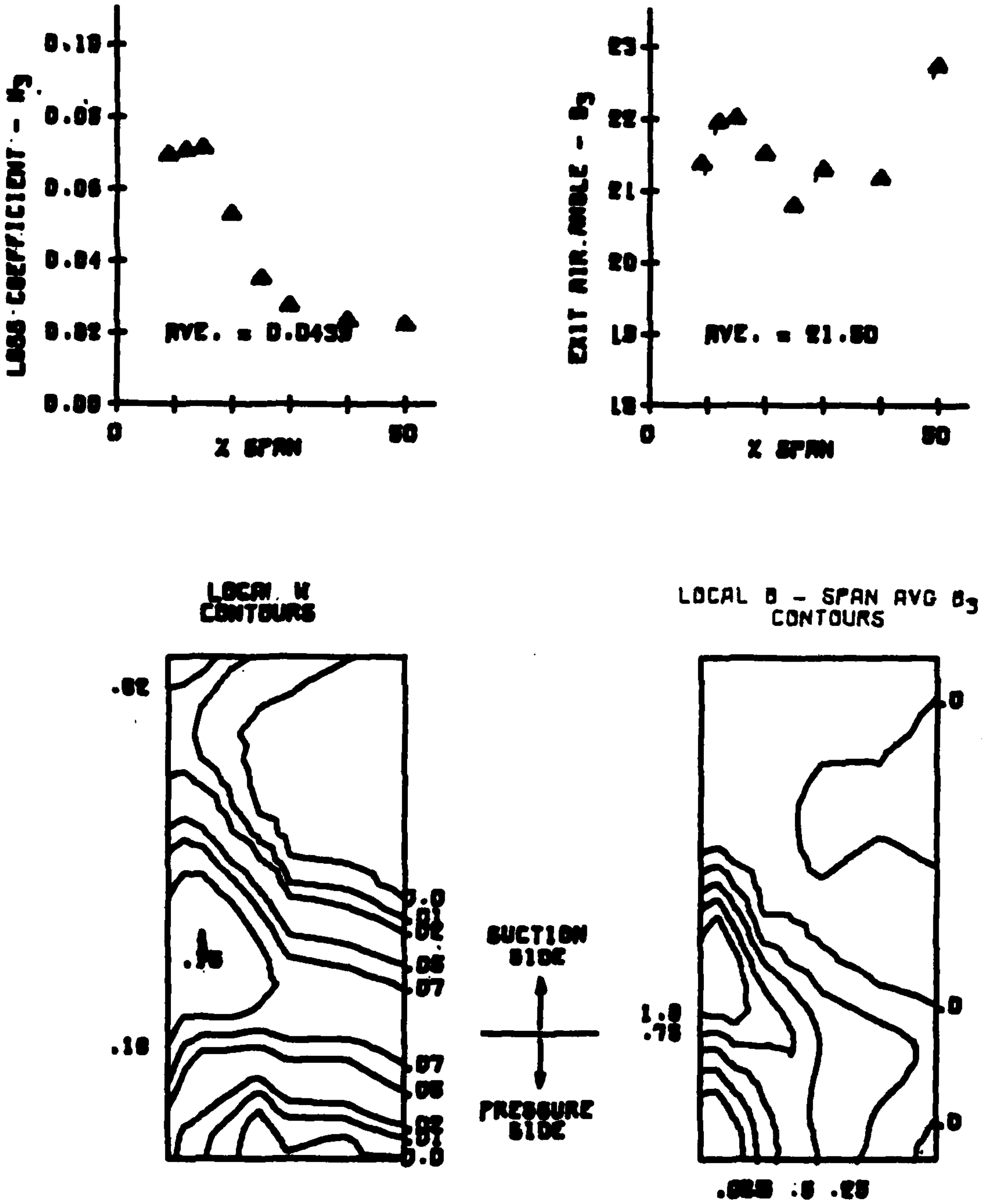


*** LEGEND ***

	F (E-06)
A	-2200.00
B	-3100.00
C	-4000.00
D	-4900.00
E	-5799.99
F	-6699.99
G	-7599.98
H	-8499.98
MAX	-2208.20
MIN	-8647.31

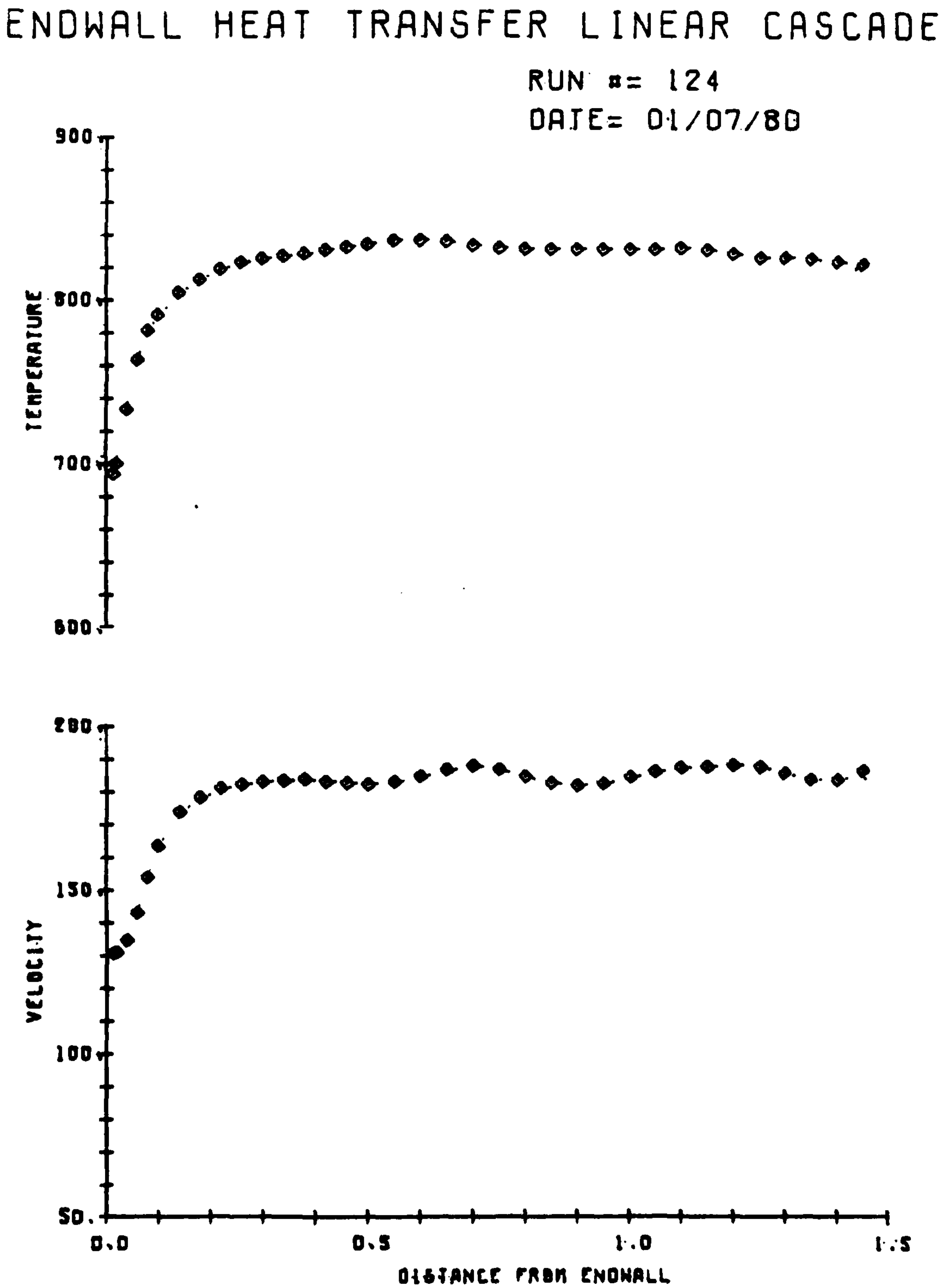
RUN 124 MACH.3 TGAS 800 RE .56E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 18:19:57 80/014


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 124
DATE= 01/07/80
EXPANSION RATIO= 1.064
AIRFLOW
PRESSURE
SUCTION
MID SPAN
20% SPAN
5% SPAN
V OVER V CRITICAL
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.
20.
40.
60.
80.
100.
PERCENT CHORD



EXIT MACH NO. = 0.30 REYNOLDS NO. = 5.08 X 10^5

<u>RUN 124 AERODYNAMIC EXIT DATA</u>


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 124
DATE= 01/07/80
900
800
700
600
TEMPERATURE
200
150
100
50
VELOCITY
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

GMA 200 TURBINE VANE CASCADE

RUN #101 DATE: 2/8/80 TIME: 4:10: 8

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
63.65	63.49	1280.30	.090	.098	.283

STANTON CALCULATION INPUT

RHO =LBM/IN3 *10**4	VELOCITY = IN/HR	STREAM TEMPERATURE = F
.77641	6841466.	818.74

CP = BTU/LBM/F
.257

MASS FLOW RATE

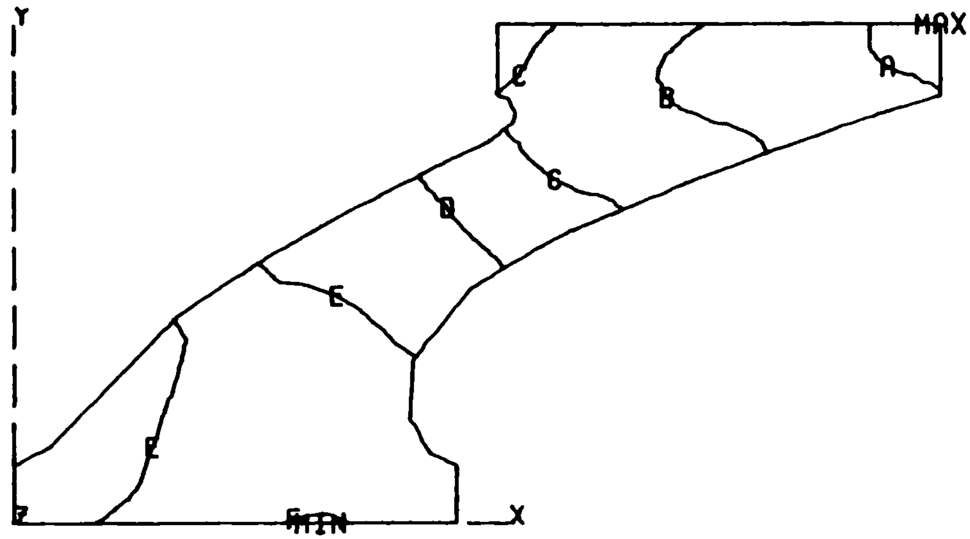
ORIFICE 5.69 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
63.45	59.95	1280.30	.305	.320	.926

CASCADE OPERATING CONDITION

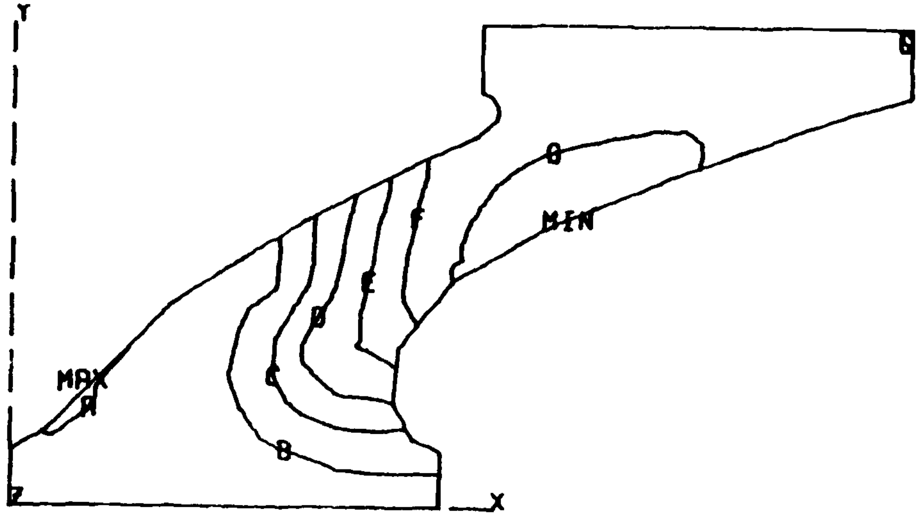
EXPANSION RATIO= 1.065 STATIC PRESSURE RATIO= .944



*** LEGEND ***

	F
A	630.00
B	610.00
C	590.00
D	570.00
E	550.00
F	530.00
MAX	638.05
MIN	528.84

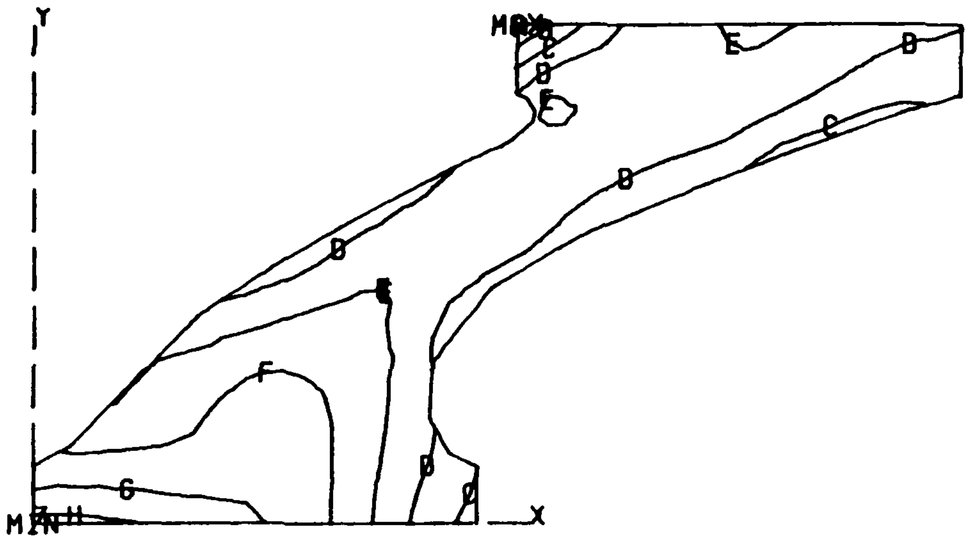
RUN 131 MACH .3 TGAS 840 RE .9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:43:12 80/046



*** LEGEND ***

	PSI (E-03)
A	63599.97
B	62999.97
C	62399.96
D	61799.96
E	61199.95
F	60599.94
G	59999.94
MAX	63621.54
MIN	59665.22

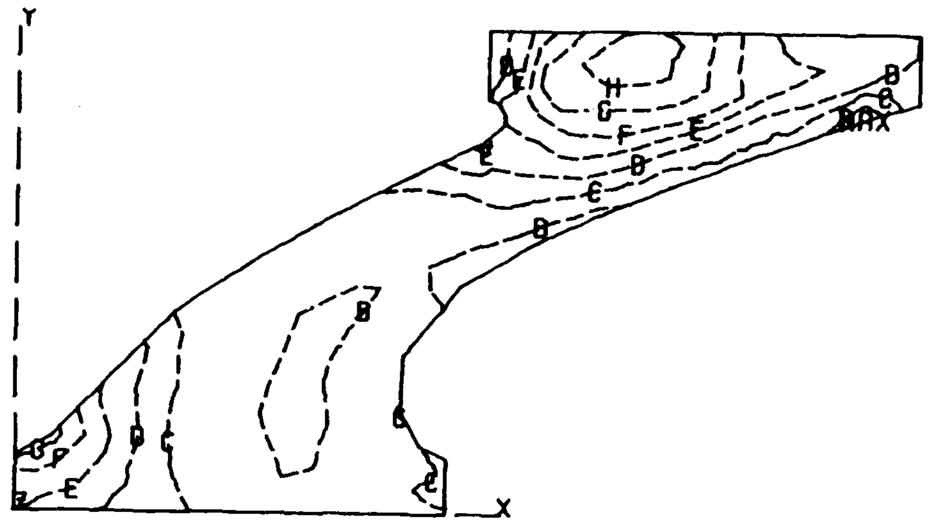
RUN 131 MACH .3 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:01:06 80/176



*** LEGEND ***

	F
A	750.00
B	743.00
C	736.00
D	729.00
E	722.00
F	715.00
G	708.00
H	701.00
MAX	750.97
MIN	698.58

RUN 125 MACH.3 TGAS 800 RE .92E06 ADIABATIC
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 11:35:47 80/036

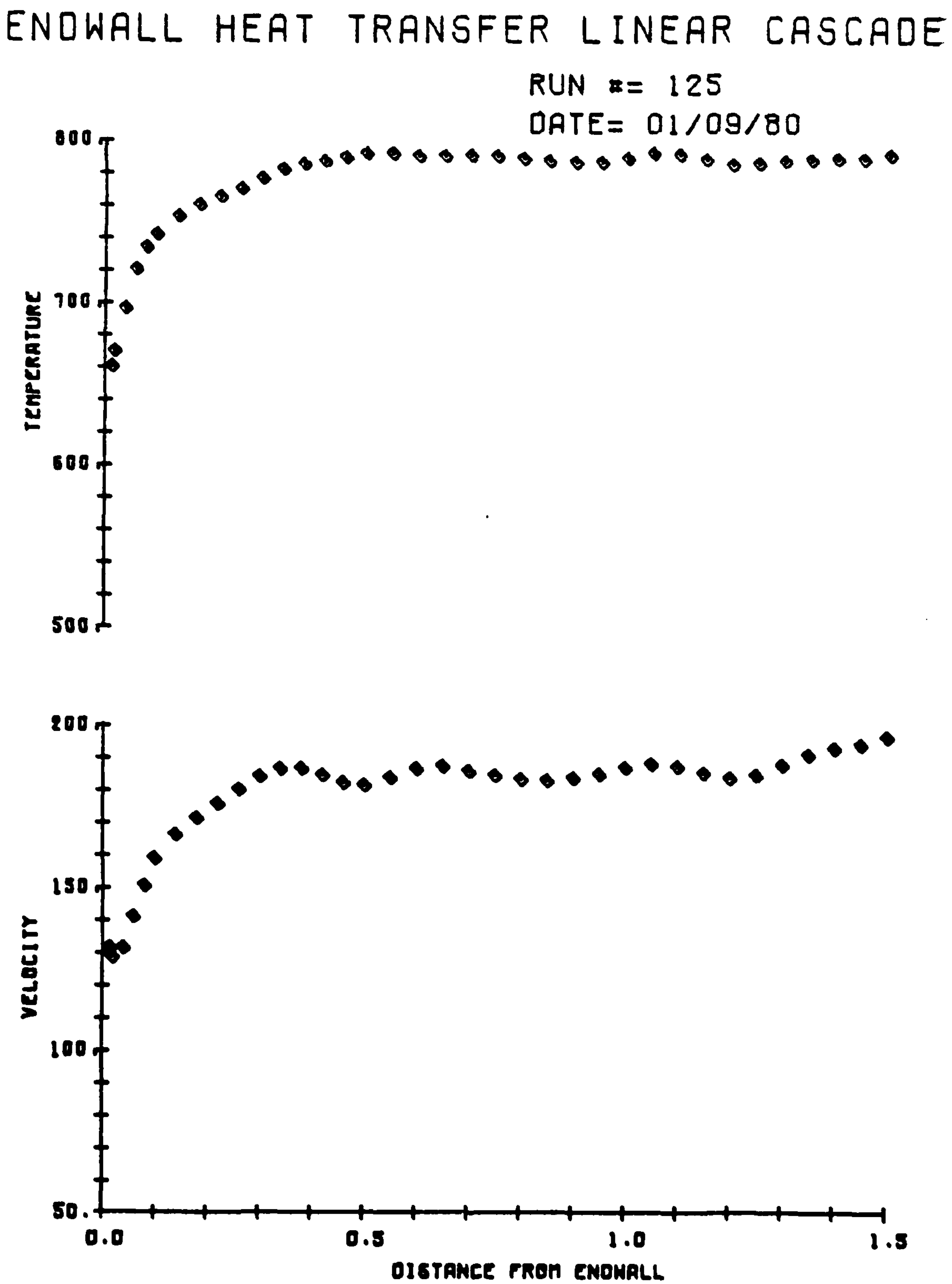


*** LEGEND ***

	F (E-06)
A	-2000.00
B	-3000.00
C	-4000.00
D	-5000.00
E	-6000.00
F	-6999.99
G	-7999.99
H	-8999.99
MAX	-2153.22
MIN	-9410.52

RUN 131 MACH .3 TGAS 840 RE .9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 17:43:36 80/046



ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 125
DATE= 01/09/80
TEMPERATURE
800
700
600
500
VELOCITY
200
150
100
50.
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

GMA 200 TURBINE VANE CASCADE

RUN #132 DATE: 2/8/80 TIME: 7:42:42

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
34.68	33.92	1284.28	.181	.196	.324

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.41507	13700412.	817.03

CP - BTU/LBM/F
.257

MASS FLOW RATE

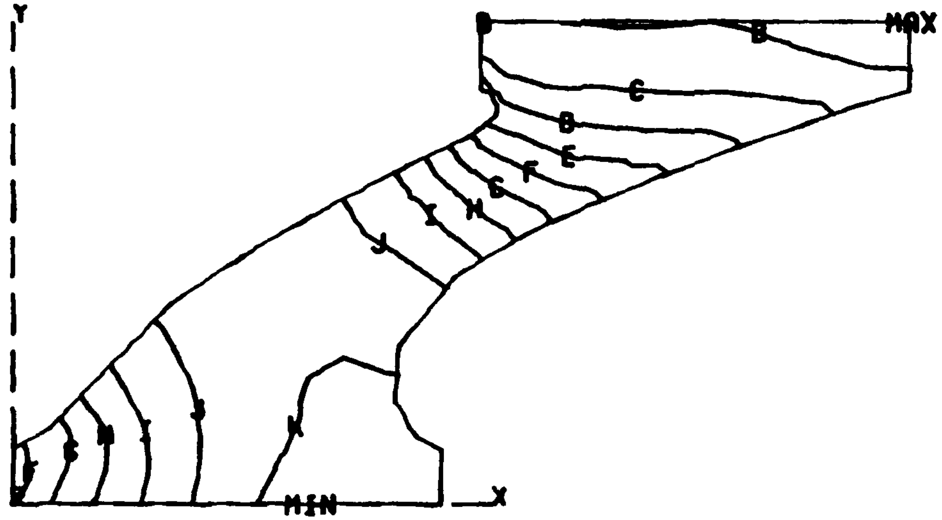
ORIFICE 5.72 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
34.68	25.46	1284.28	.686	.717	.945

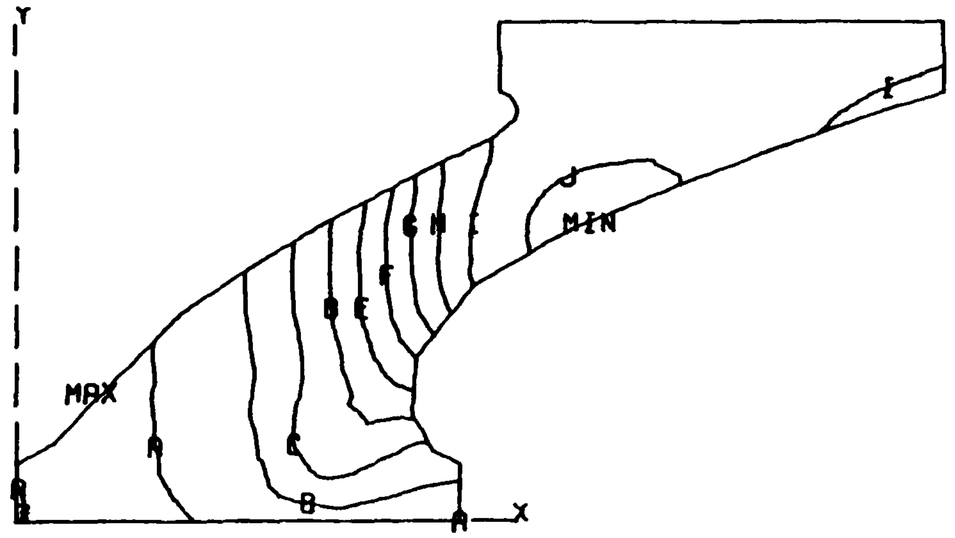
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.362 STATIC PRESSURE RATIO= .751



*** LEGEND ***	F
A	650.00
B	640.00
C	630.00
D	620.00
E	610.00
F	600.00
G	590.00
H	580.00
I	570.00
J	560.00
K	550.00
MAX	650.03
MIN	545.04

RUN 132 MACH .7 TGAS 800 RE.9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:57:19 80/050

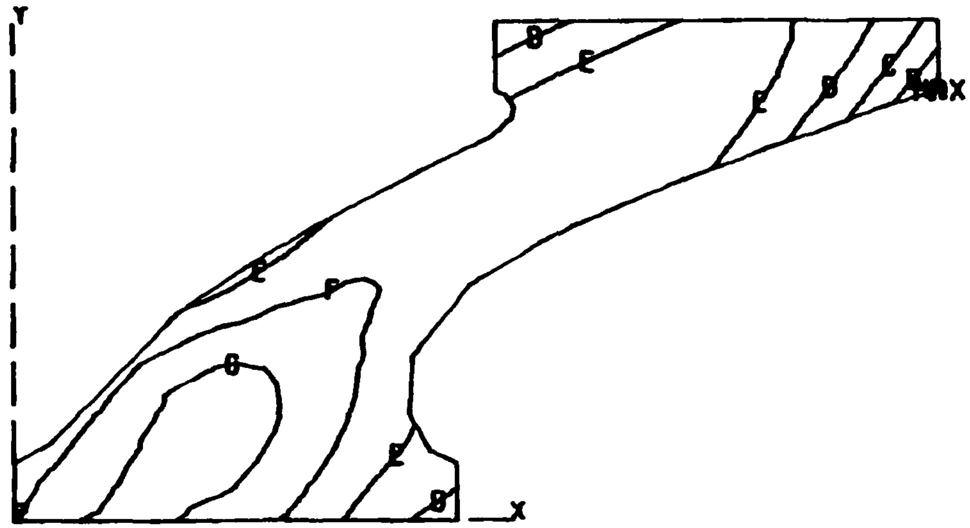


*** LEGEND ***	PSI
A	34.00
B	33.00
C	32.00
D	31.00
E	30.00
F	29.00
G	28.00
H	27.00
I	26.00
J	25.00
MAX	34.24
MIN	24.51

RUN 132 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS

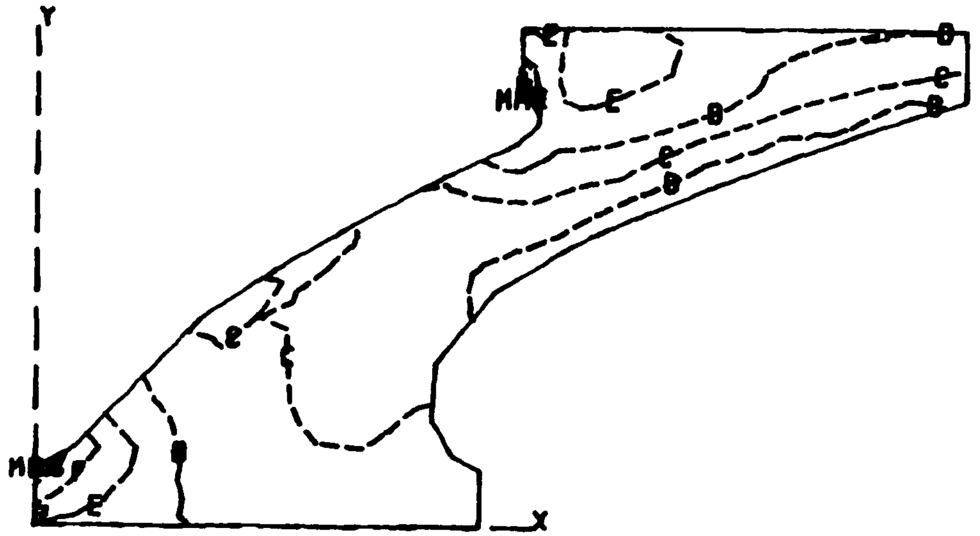
CONTOUR PLOT OF PRESSURE

SCALE = 1.0000 PLOT TIME AND DATE = 11:51:44 80/162



***	LEGEND F	***
A	786.00	
B	776.00	
C	766.00	
D	756.00	
E	746.00	
F	736.00	
G	726.00	
MAX	786.95	
MIN	719.75	

RUN 132 MACH .7 TGAS 800 RE2 .9E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 7:53:38 80/163



*** LEGEND ***

f

(E-03)

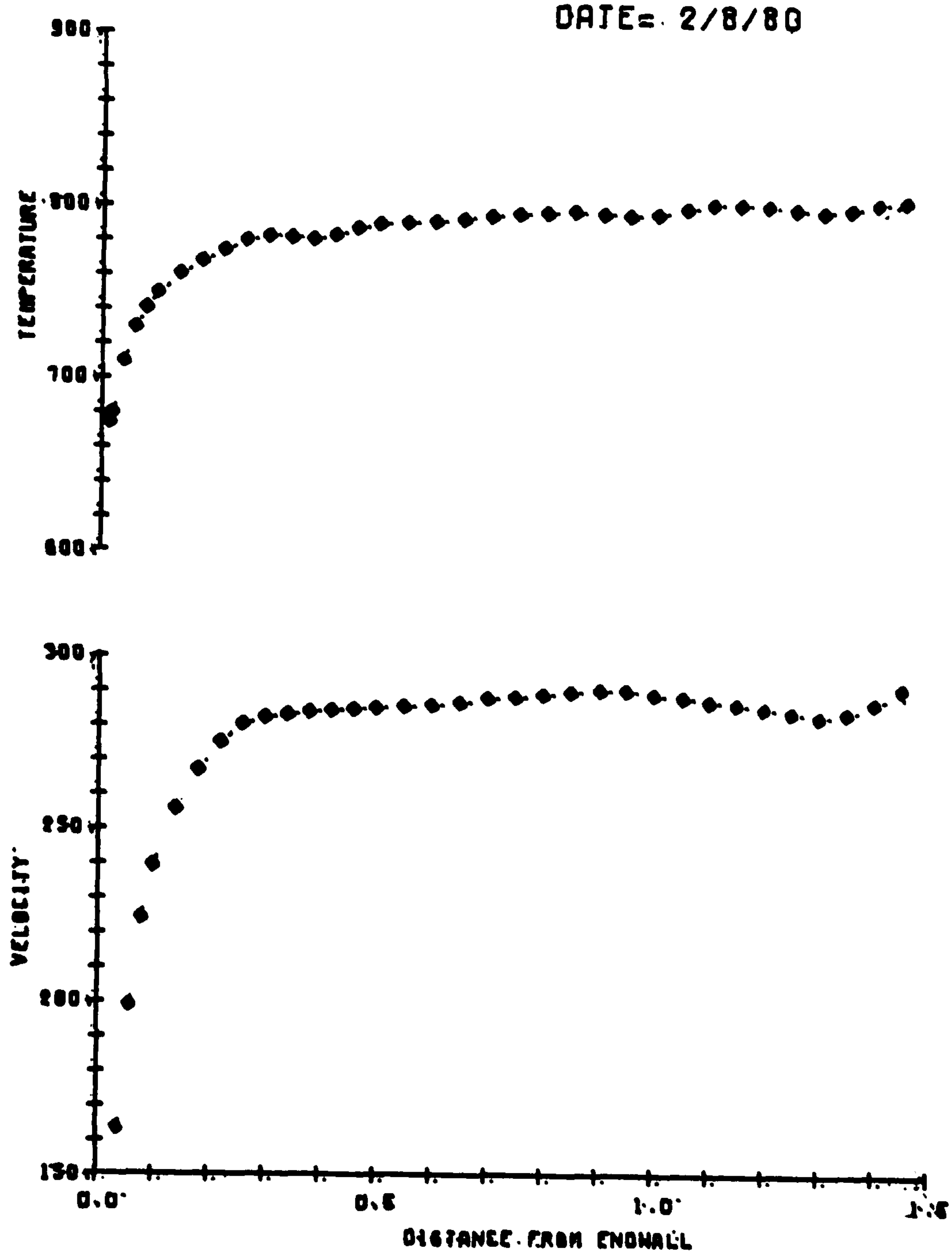
B	-1.00
C	-3.00
D	-5.00
E	-7.00
F	-9.00
G	-11.00
H	-13.00
MIN	-13.23

RUN 132 MACH .7 TGAS 800 RE.9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 15:57:40 80/050

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 132
DATE= 2/8/80



GMA 200 TURBINE VANE CASCADE

RUN #153 DATE: 2/8/80 TIME: 8:59: 3

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
34.01	33.30	1283.77	.176	.190	.289

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.40757	13282360.	816.98

CP - BTU/LBM/F
.257

MASS FLOW RATE

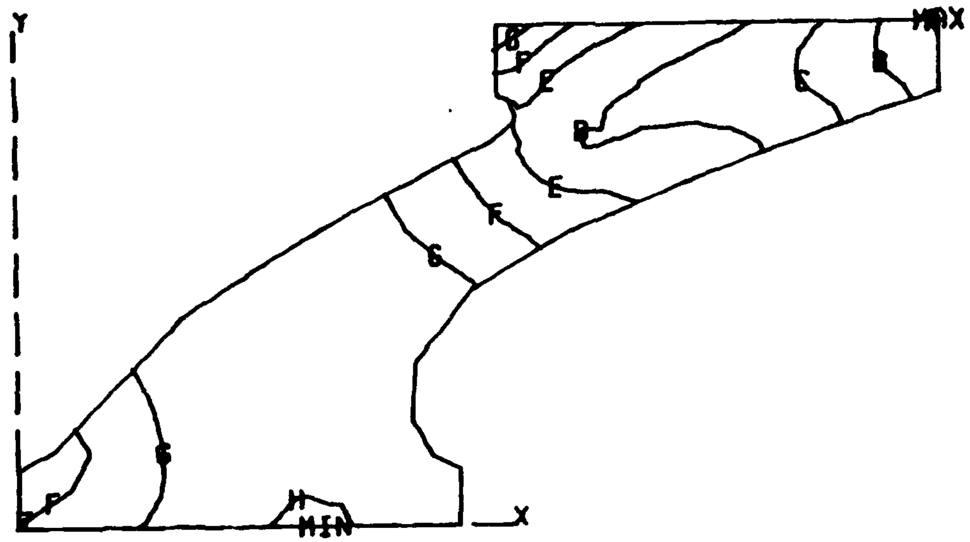
ORIFICE 4.29 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
34.01	24.86	1283.77	.693	.722	.931

CASCADE OPERATING CONDITION

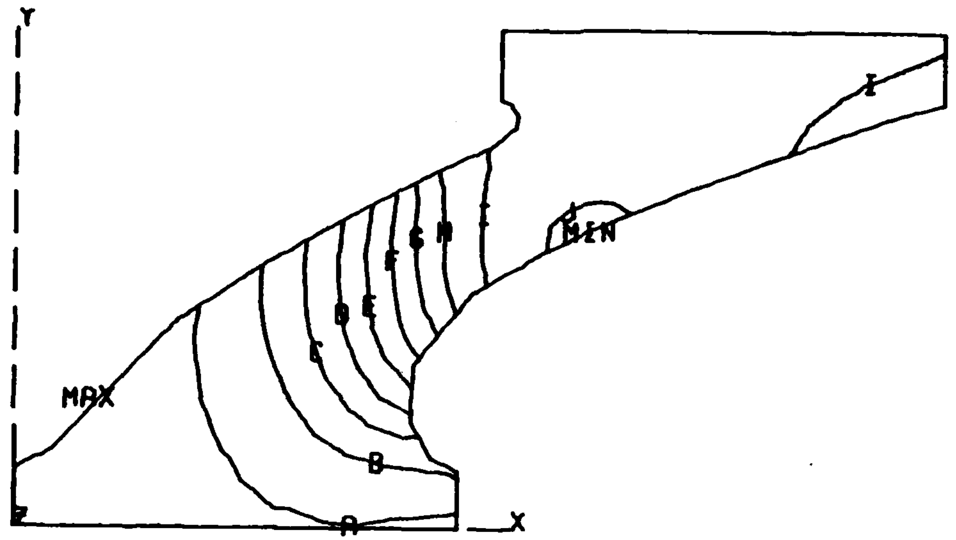
EXPANSION RATIO= 1.368 STATIC PRESSURE RATIO= .746



*** LEGEND ***

	F
A	536.00
B	527.00
C	518.00
D	509.00
E	500.00
F	491.00
G	482.00
H	473.00
MAX	536.96
MIN	471.89

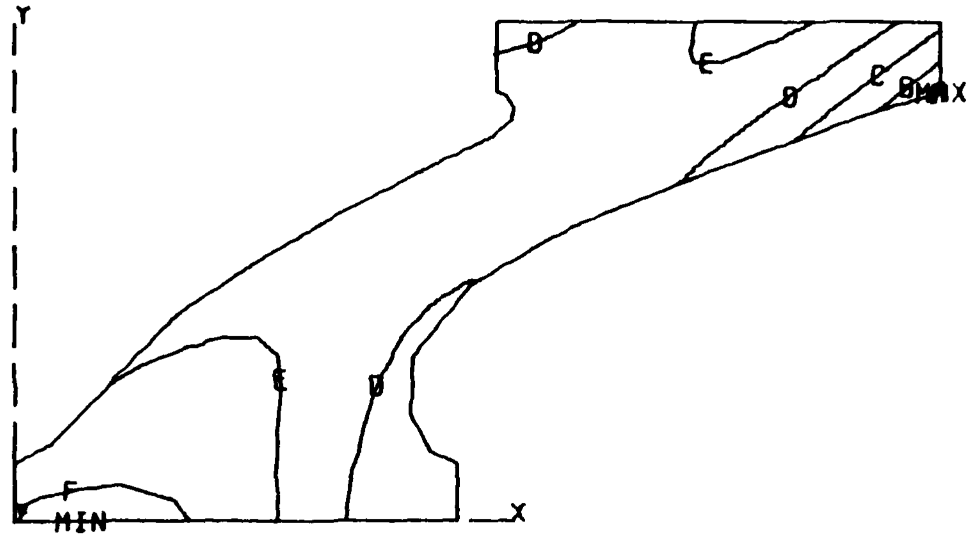
133 MACH .7 TGAS 800 RE.9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:54:35 80/050



*** LEGEND ***

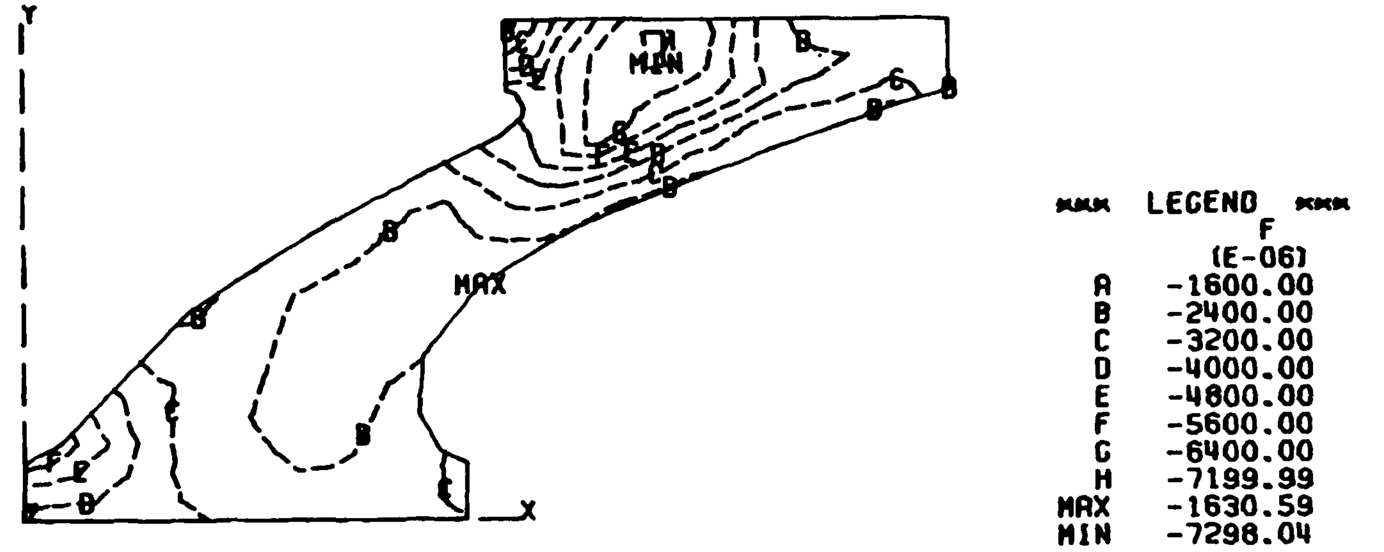
	PSI
A	33.00
B	32.00
C	31.00
D	30.00
E	29.00
F	28.00
G	27.00
H	26.00
I	25.00
J	24.00
MAX	33.59
MIN	23.77

RUN 133 MACH .7 TGAS 800 ENDWALL PRESURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:02:54 80/162



*** LEGEND ***	F
A	800.00
B	780.00
C	760.00
D	740.00
E	720.00
F	700.00
MAX	801.27
MIN	692.98

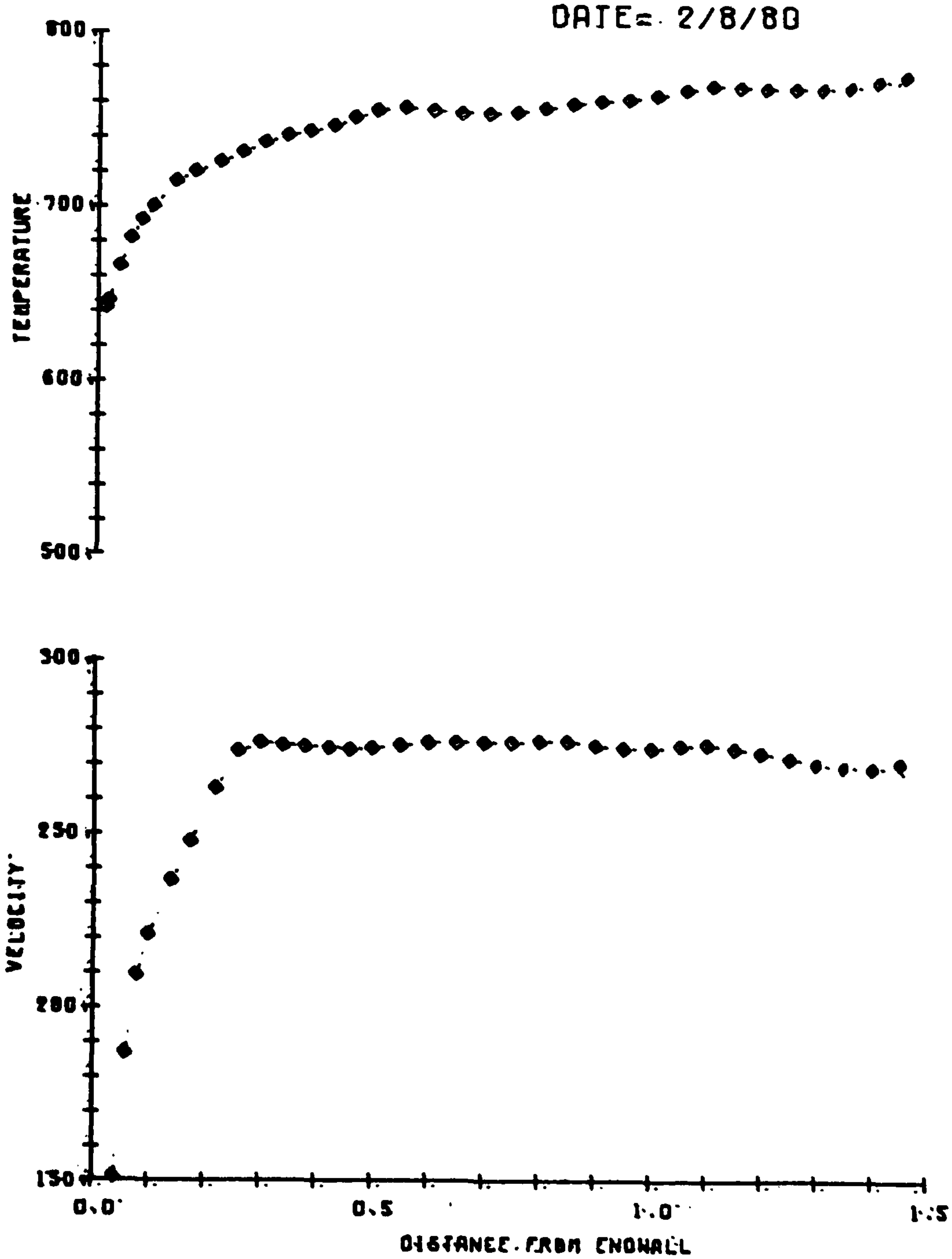
RUN 133 M2 .7 TGAS 800 RE2 .9E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:42:14 80/169



RUN 133 MACH .7 TGAS 800 RE.9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 16:54:58 80/050

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 133
DATE= 2/8/80



GMA 200 TURBINE VANE CASCADE

RUN #149 DATE: 3/27/80 TIME: 9:21: 8

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
32.67	31.69	1262.35	.212	.229	.339

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.39542	15656892.	792.47

CP - BTU/LBM/F
.257

MASS FLOW RATE

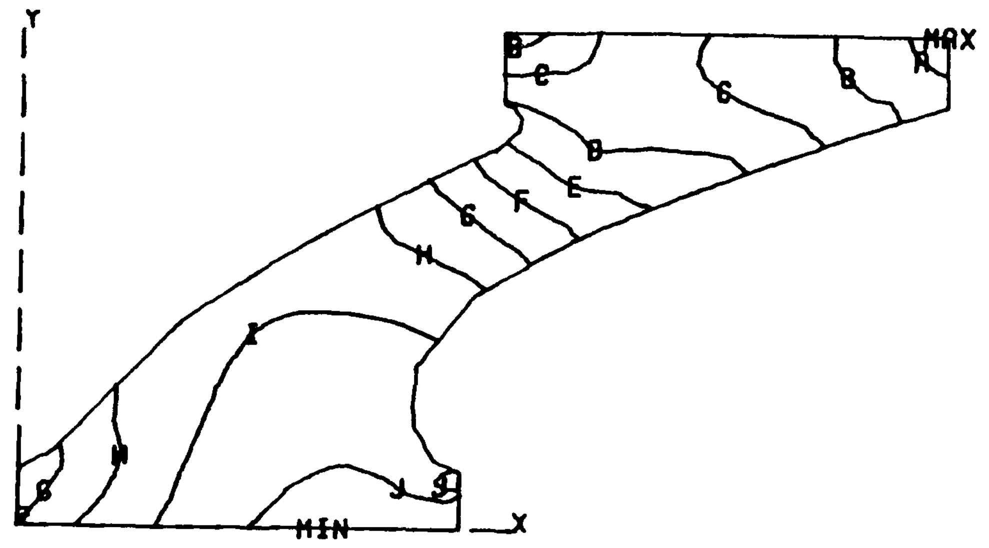
ORIFICE 5.46 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
32.67	23.99	1262.35	.687	.717	.908

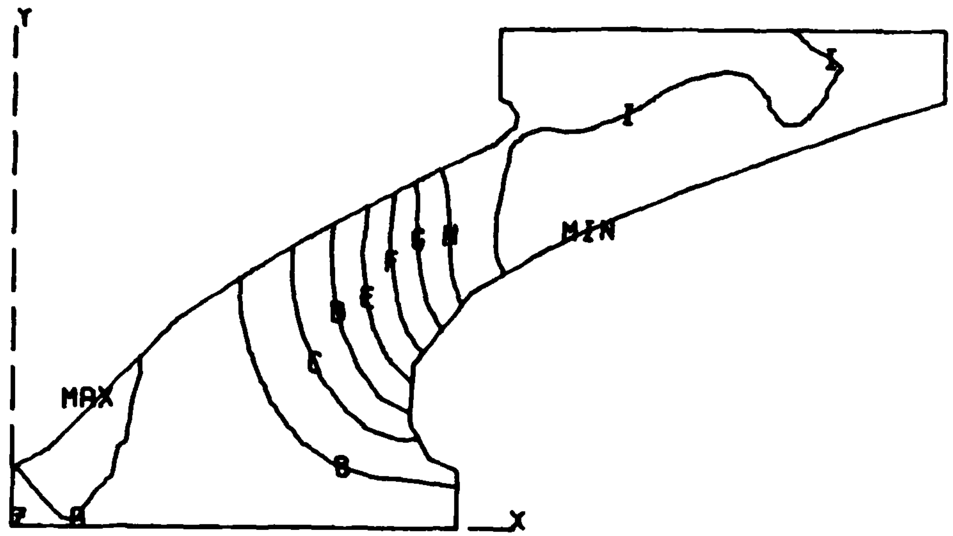
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.361 STATIC PRESSURE RATIO= .757



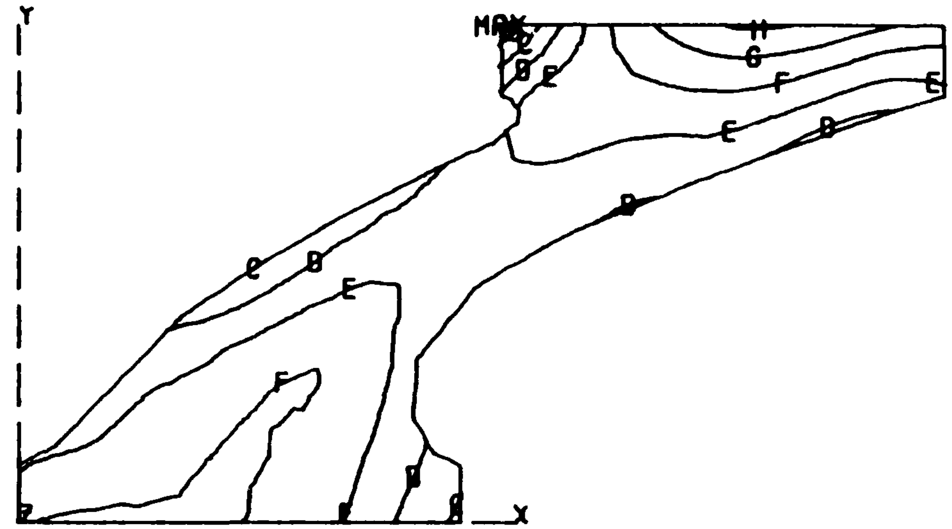
*** LEGEND ***	F
A	600.00
B	590.00
C	580.00
D	570.00
E	560.00
F	550.00
G	540.00
H	530.00
I	520.00
J	510.00
MAX	605.09
MIN	506.52

RUN 149 MACH .7 TGAS 800 RE .9E06 H.T. ENDWALL THICK B.L.
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:17:50 80/092



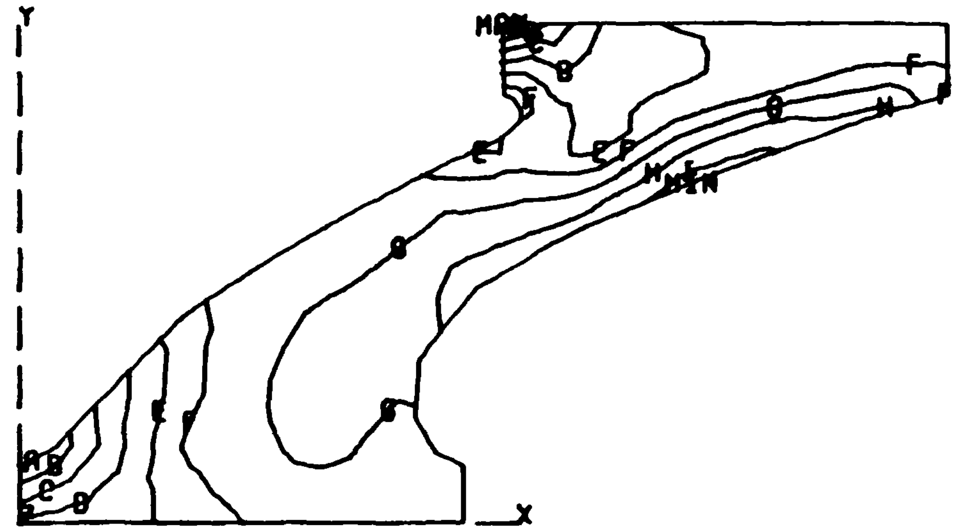
*** LEGEND ***	
	PSI
A	32.00
B	31.00
C	30.00
D	29.00
E	28.00
F	27.00
G	26.00
H	25.00
I	24.00
MAX	32.17
MIN	23.12

RUN 149 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 14:39:38 80/162



*** LEGEND ***	F
A	764.00
B	757.00
C	750.00
D	743.00
E	736.00
F	729.00
G	722.00
H	715.00
MAX	764.13
MIN	714.16

RUN 149 MACH .7 TGAS 800 RE .9E06 ADIABATIC ENDWALL THICK B.L.
CONTOUR PLOT OF TEMPERATURE
SCALE =   1.0000   PLOT TIME AND DATE = 16:32:41 80/092



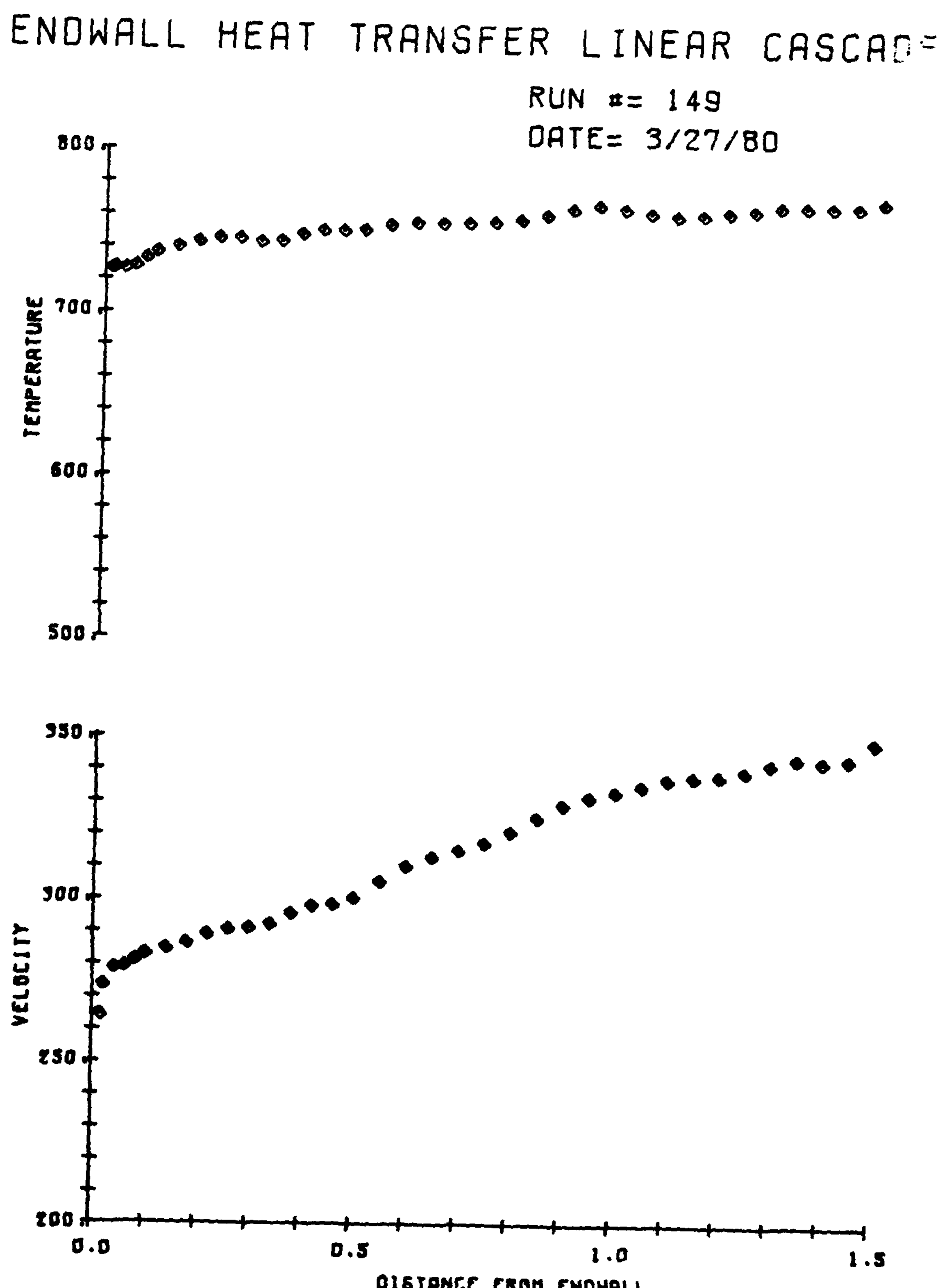
*** LEGEND ***

	F (E-06)
A	9000.00
B	8000.00
C	6999.99
D	5999.99
E	4999.99
F	3999.99
G	2999.99
H	1999.99
I	999.99
MAX	9621.72
MIN	481.87

RUN 149 MACH .7 TGAS 800 RE .9E06 H.T. ENDWALL THICK B.L.

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 17:18:21 80/092


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 149
DATE= 3/27/80
800
700
600
500
TEMPERATURE
350
300
250
200
VELOCITY
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

GMA 200 TURBINE VANE CASCADE

RUN #150 DATE: 3/27/809 TIME: 10:11:33

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
34.59	34.31	1253.40	.109	.119	.190

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.42863	8077319.	791.01

CP - BTU/LBM/F
.257

MASS FLOW RATE

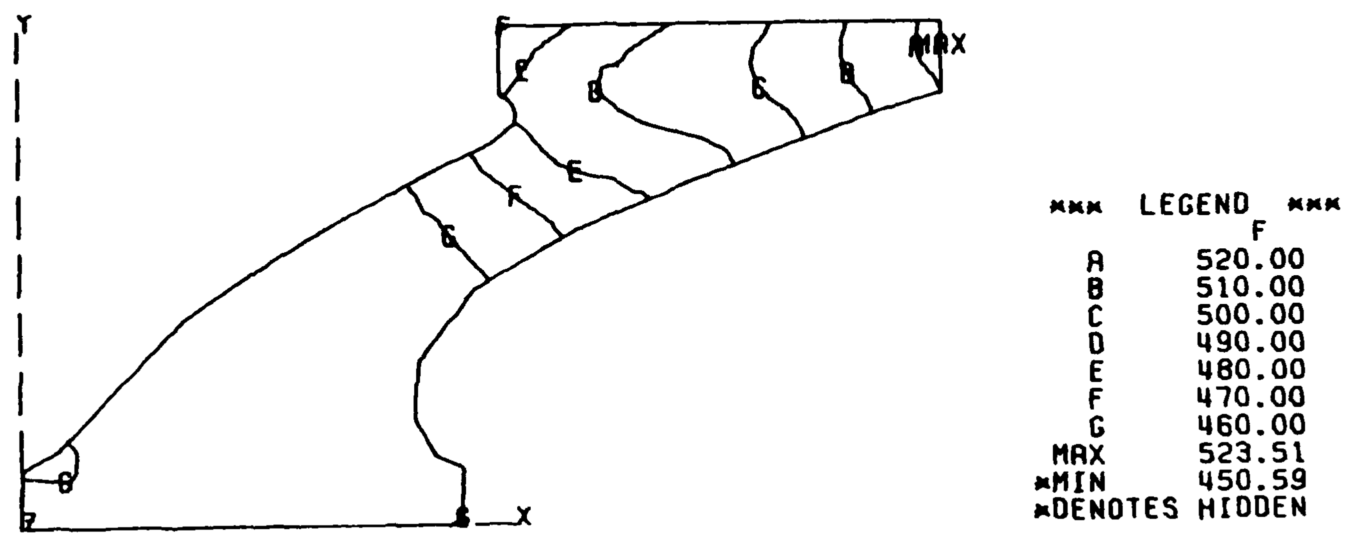
ORIFICE 2.98 CASCADE

IDEAL EXIT CONDITIONS

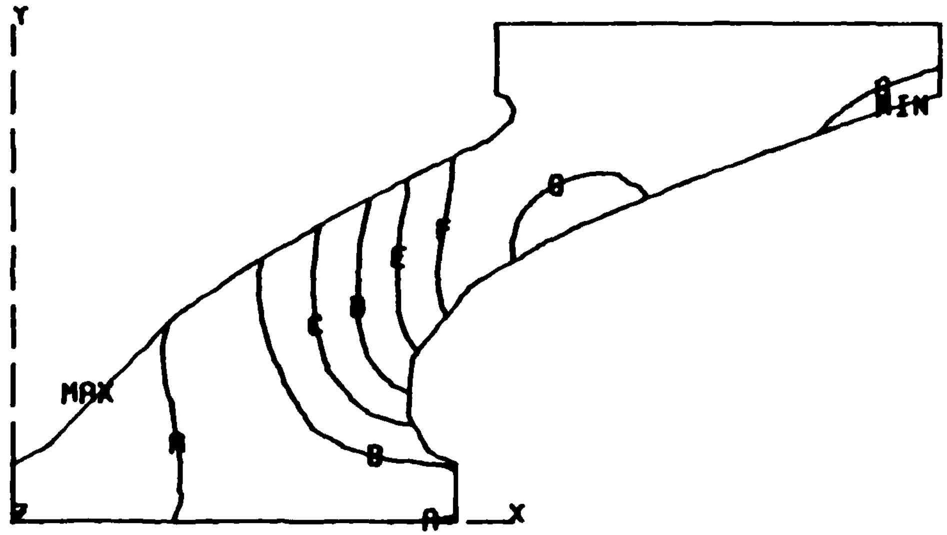
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
34.59	32.65	1253.40	.292	.315	.491

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.059 STATIC PRESSURE RATIO= .952

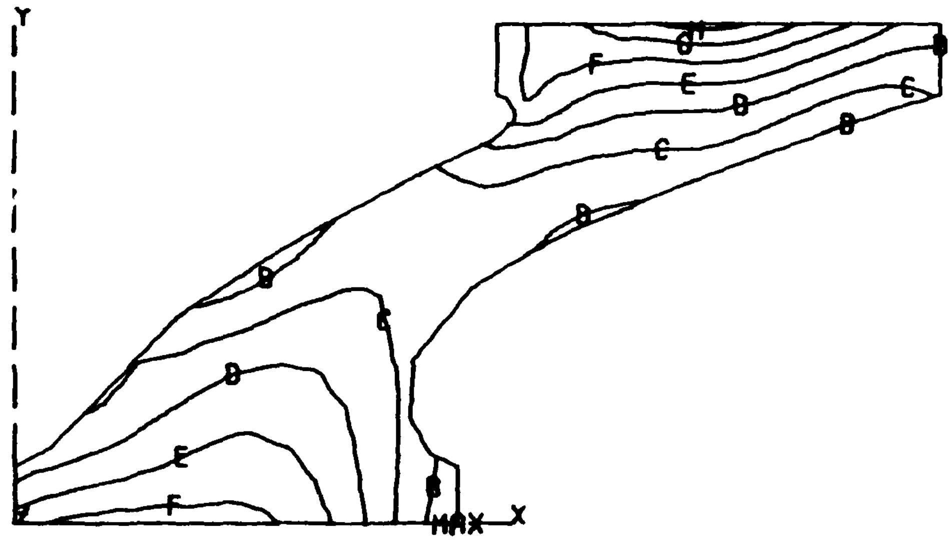


RUN 150 MACH .3 TGAS 800 RE .5E06 H.T. ENDWALL THICK B.L.
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 14:17:51 80/151



*** LEGEND ***	
	PSI
	(E-03)
A	34299.97
B	33999.97
C	33699.96
D	33399.96
E	33099.96
F	32799.96
G	32499.95
MAX	34383.76
MIN	32381.67

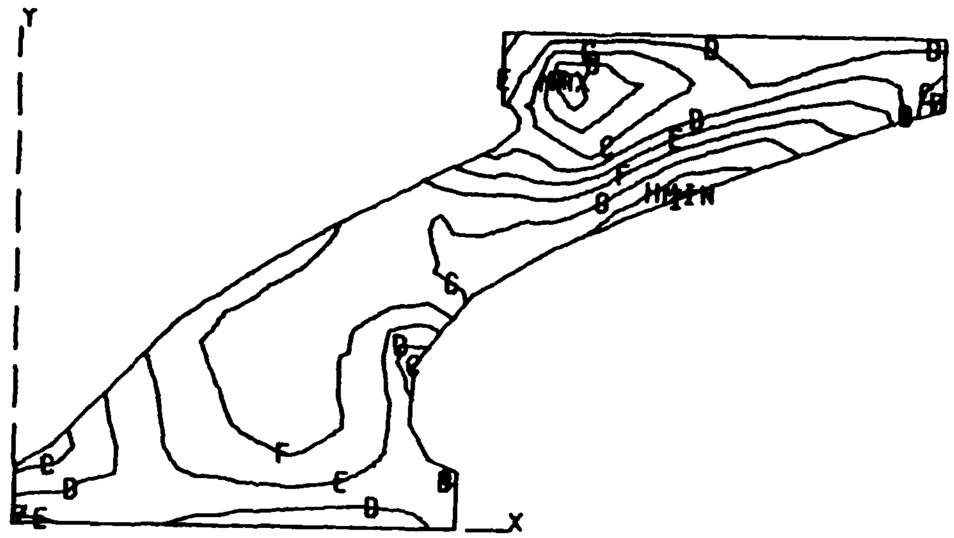
RUN 150 MACH .3 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:40:37 80/168



*** LEGEND ***

	F
A	757.00
B	750.00
C	743.00
D	736.00
E	729.00
F	722.00
G	715.00
H	708.00
MAX	757.08
MIN	705.52

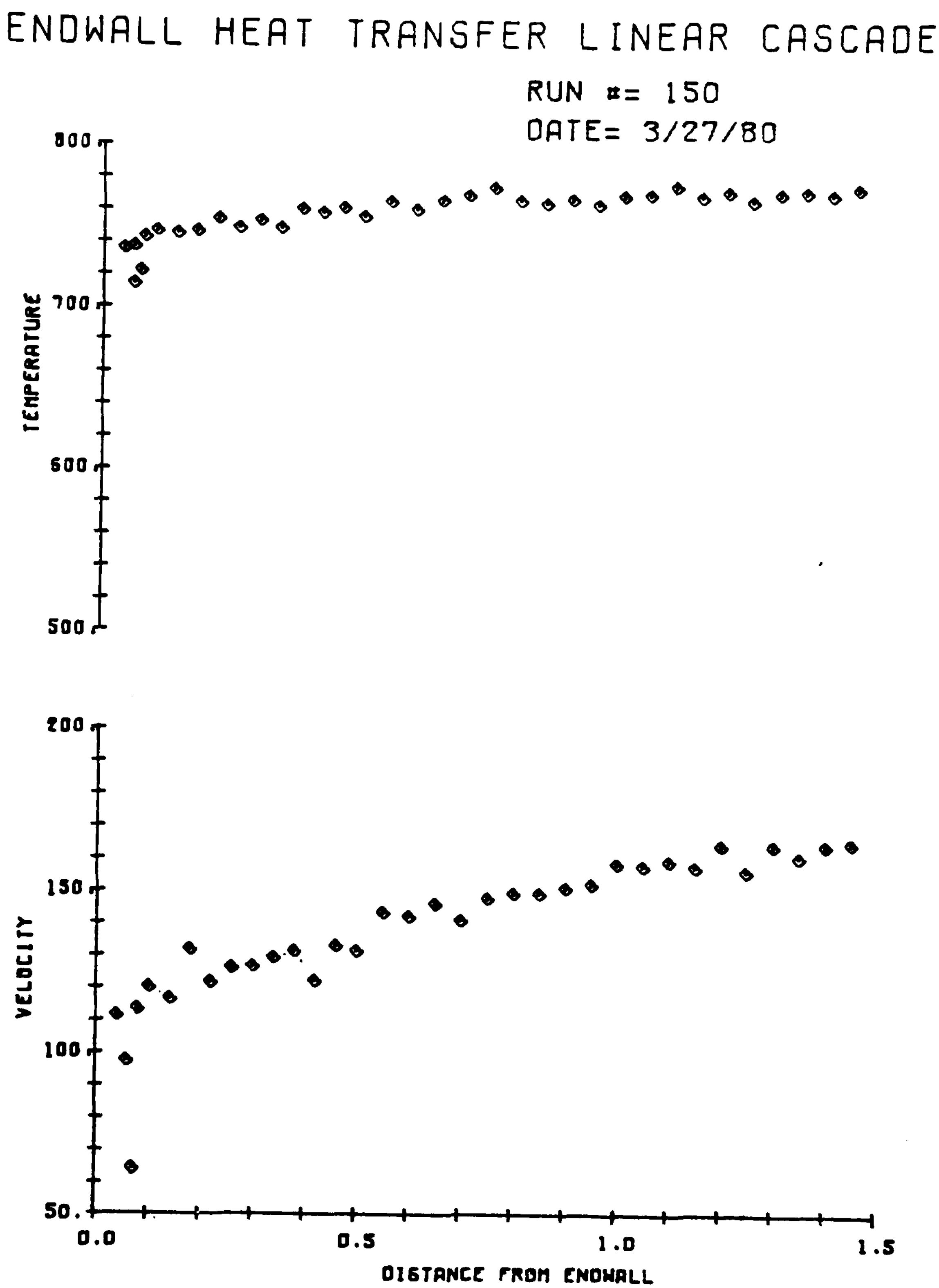
RUN 150 MACH .3 TGAS 800 RE .5E06 ADIABATIC ENDWALL THICK B.L.
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:42:06 80/092



*** LEGEND ***

	F (E-06)
A	9000.00
B	8000.00
C	6999.99
D	5999.99
E	4999.99
F	3999.99
G	2999.99
H	1999.99
I	999.99
MAX	9604.82
MIN	759.50

RUN 150 MACH .3 TGAS 800 RE .5E06 H.T. ENDWALL THICK B.L.
CONTOUR PLOT OF STANTON NUMBER,
SCALE = 1.0000 PLOT TIME AND DATE = 14:19:13 80/151


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 150
DATE= 3/27/80
TEMPERATURE
800
700
600
500
VELOCITY
200
150
100
50.
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

GMA 200 TURBINE VANE CASCADE

RUN #165 DATE: 5/14/80 TIME: 4:18:37

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
33.47	33.03	1265.29	.139	.151	.231

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.40936	10339674.	801.18

CP - BTU/LBM/F
.257

MASS FLOW RATE

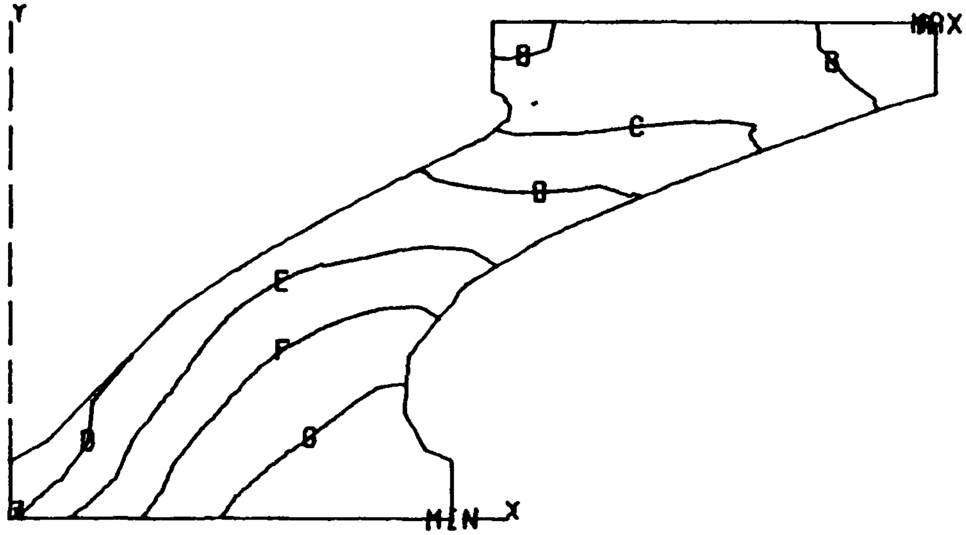
ORIFICE 4.91 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
33.47	24.13	1265.29	.708	.737	.944

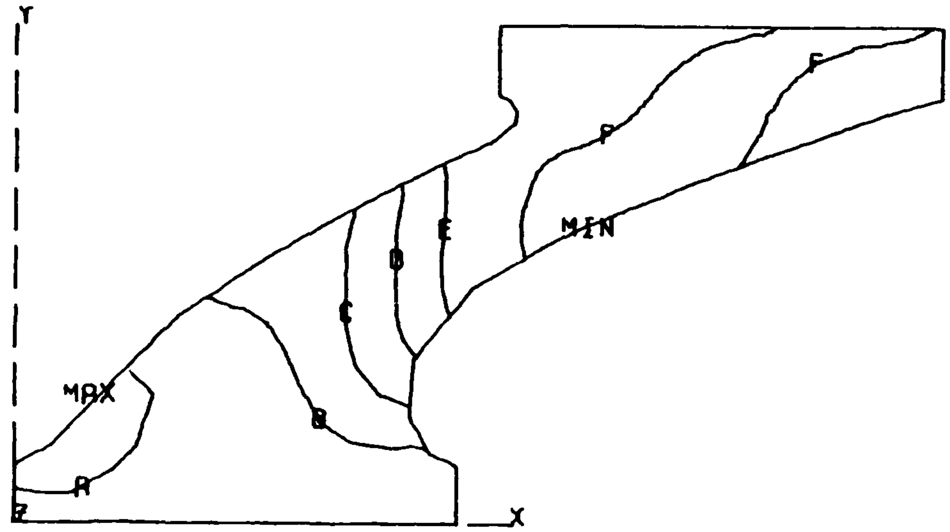
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.387 STATIC PRESSURE RATIO= .731



***	LEGEND	***
	F	
A	547.00	
B	537.00	
C	527.00	
D	517.00	
E	507.00	
F	497.00	
G	487.00	
MAX	547.89	
MIN	478.26	

RUN 165 M2 .7 TGAS 800 RE2 .93E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:08:56 80/144

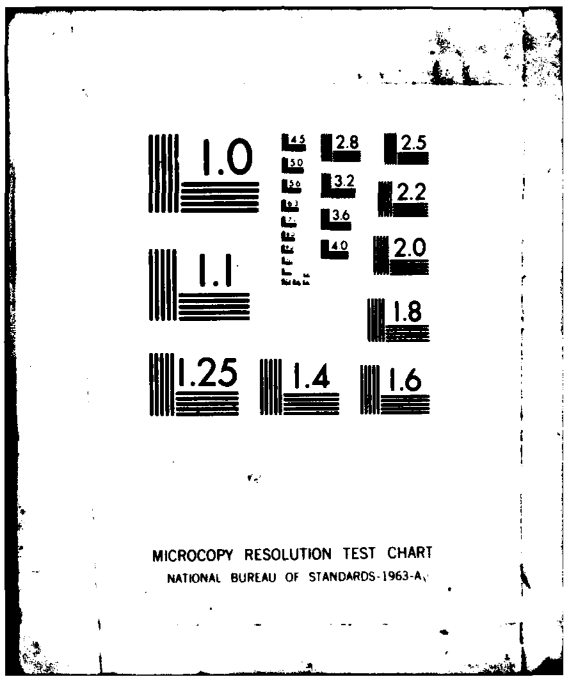


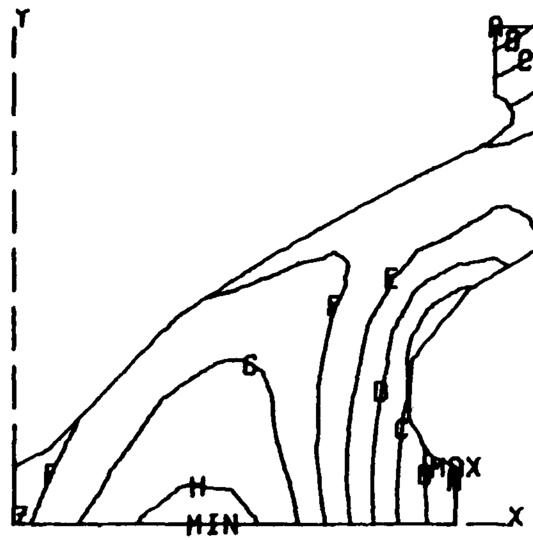
***	LEGEND ***
	PSI
A	34.00
B	32.00
C	30.00
D	28.00
E	26.00
F	24.00
MAX	34.31
MIN	23.36

RUN 165 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:14:40 80/168

AD-A110 333 GENERAL MOTORS CORP INDIANAPOLIS IN DETROIT DIESEL A--ETC F/G 21/5
EXPERIMENTAL INVESTIGATION OF TURBINE ENDWALL HEAT TRANSFER. VO--ETC(U)
AUG 81 L D HYLTON, M S MIHELC, E R TURNER F33615-77-C-2030
UNCLASSIFIED DDA-EDR-10363-VOL-2 AFWAL-TR-81-2077-VOL-2 NL

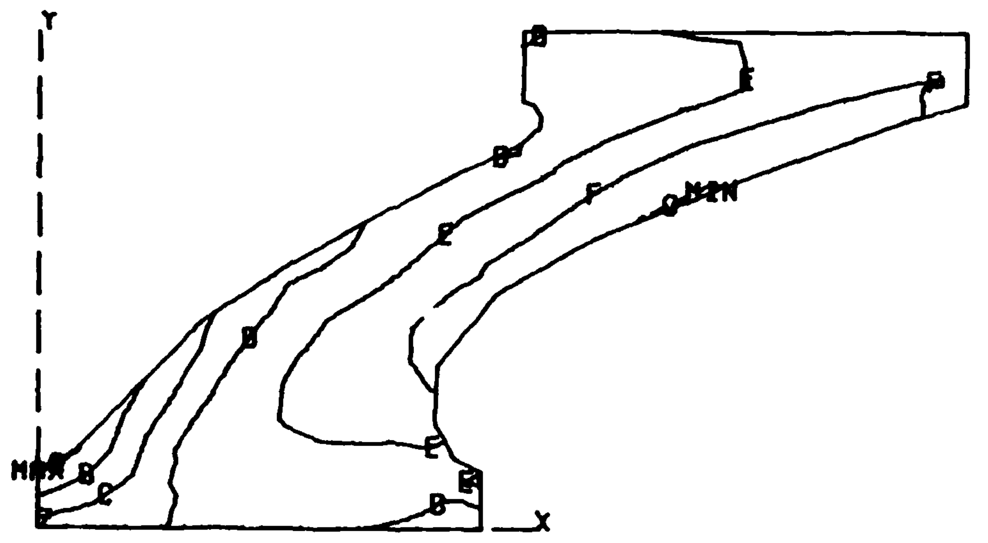
3 of 4


1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



*** LEGEND ***	F
A	627.00
B	622.00
C	617.00
D	612.00
E	607.00
F	602.00
G	597.00
H	592.00
MAX	627.54
MIN	589.85

RUN 165 M2 .7 TGAS 800 RE2 .93E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 11:33:40 80/144



*** LEGEND ***

	F (E-03)
A	12.00
B	10.00
C	8.00
D	6.00
E	4.00
F	2.00
MAX	12.30

RUN 165 M2 .7 TGAS 800 RE2 .93E06 HEAT TRANSFER ENDWALL

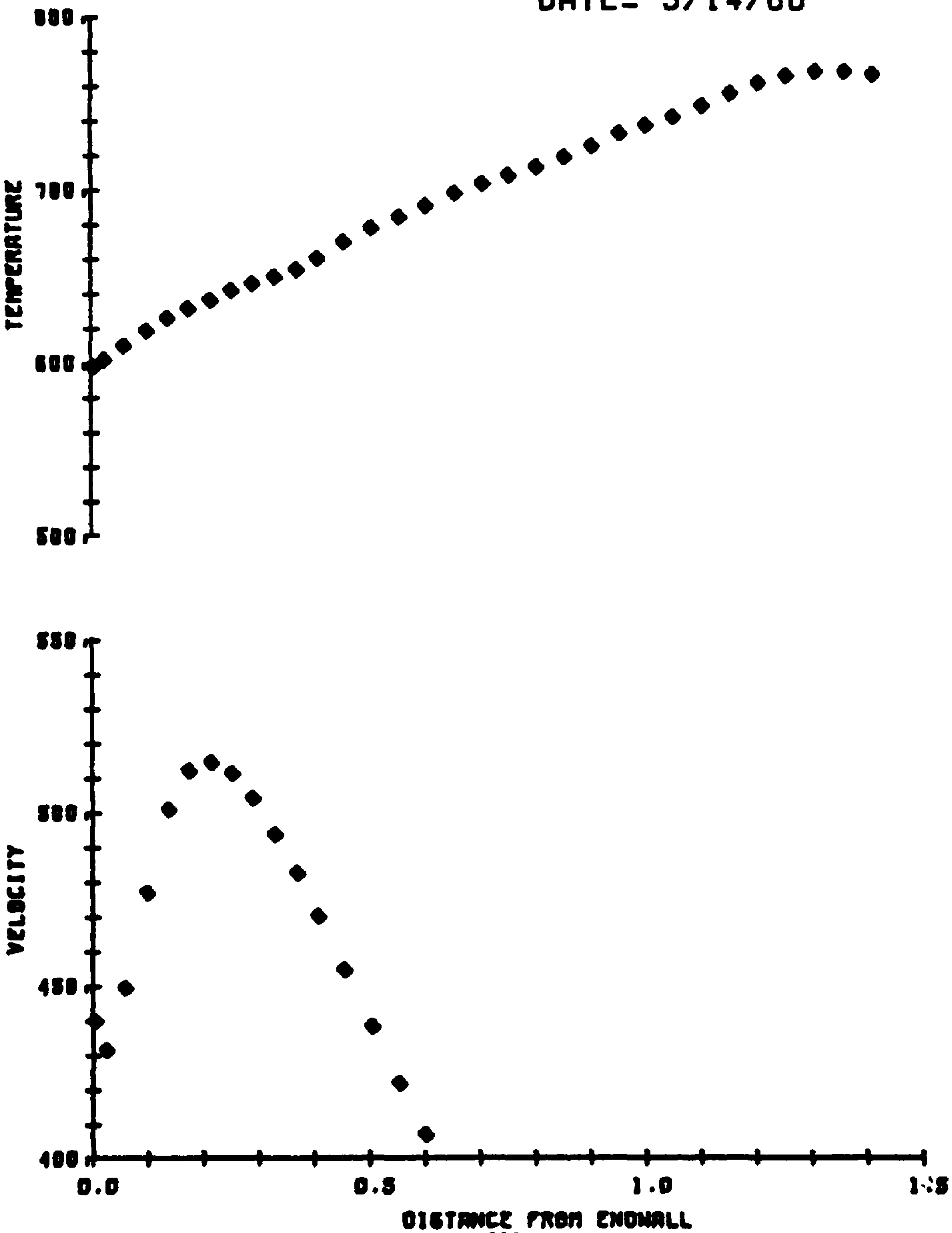
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 16:09:53 80/144

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 165

DATE= 5/14/80



GMA 200 TURBINE VANE CASCADE

RUN #166　　DATE: 5/14/80　　TIME: 7:17:22

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
58.69	57.60	1255.81	.181	.196	.529

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.72085	13346318.	788.73

CP - BTU/LBM/F
.257

MASS FLOW RATE

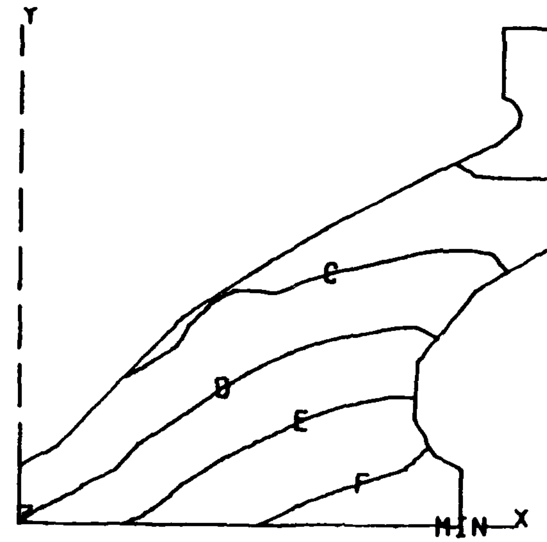
ORIFICE　　8.95　　CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
58.89	42.59	1255.81	.705	.734	1.670

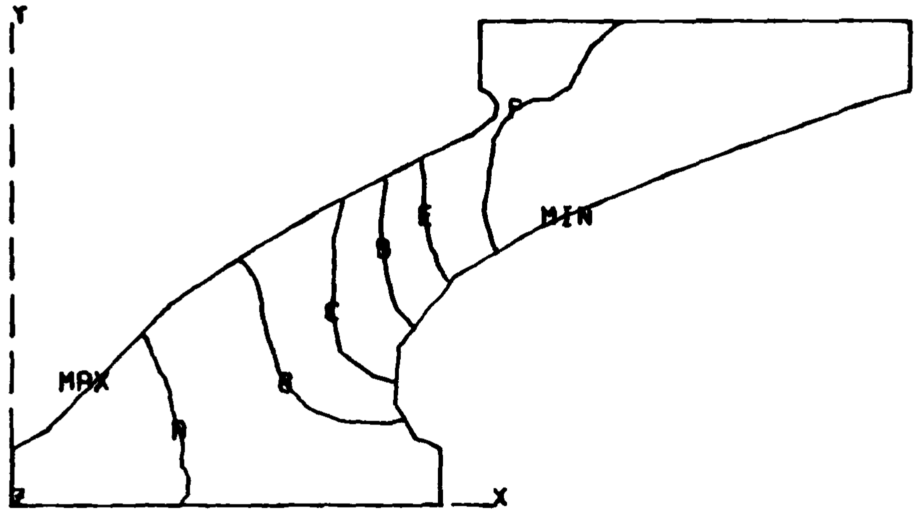
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.383　　STATIC PRESSURE RATIO= .739



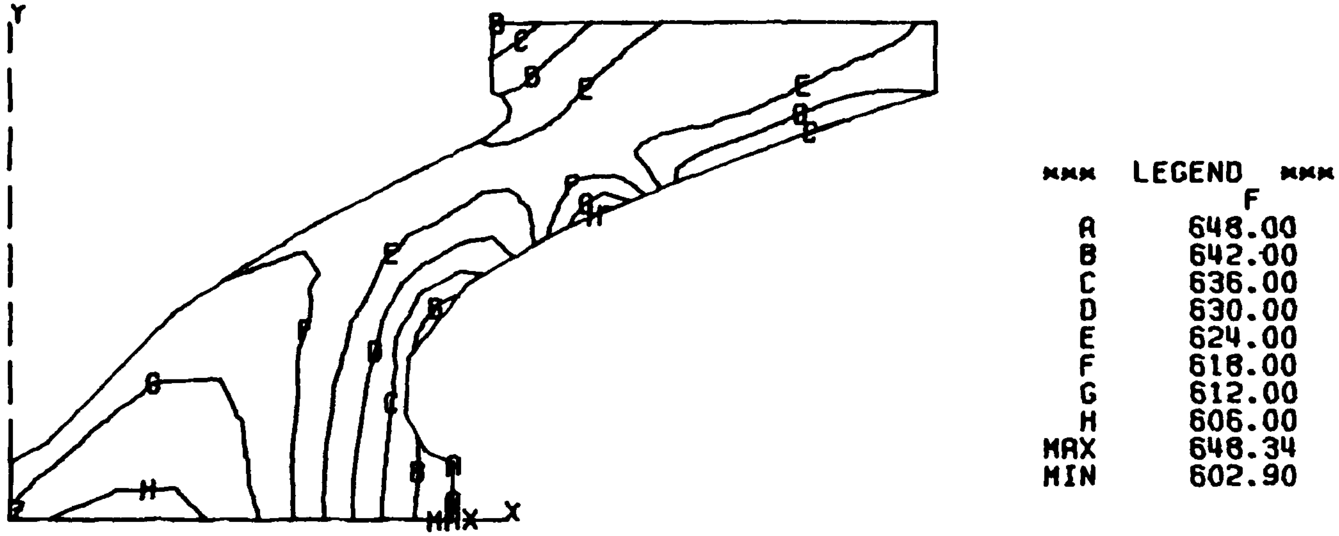
***	LEGEND	***
	F	
A	610.00	
B	590.00	
C	570.00	
D	550.00	
E	530.00	
F	510.00	
*MAX	611.53	
MIN	497.55	
*DENOTES HIDDEN		

RUN 166 M2 .7 TGAS 800 RE2 1.66E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:40:08 80/172

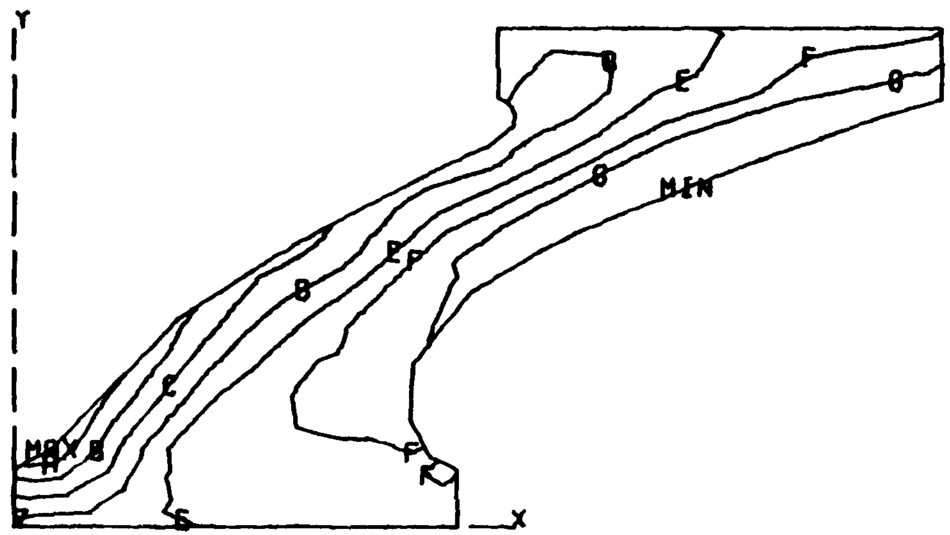


***	LEGEND	***
	PSI	
A	58.00	
B	55.00	
C	52.00	
D	49.00	
E	46.00	
F	43.00	
MAX	58.91	
MIN	41.21	

RUN 166 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:34:24 80/178



RUN 166 M2 .7 TGAS 800 AE2 1.66E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 11:00:25 80/144



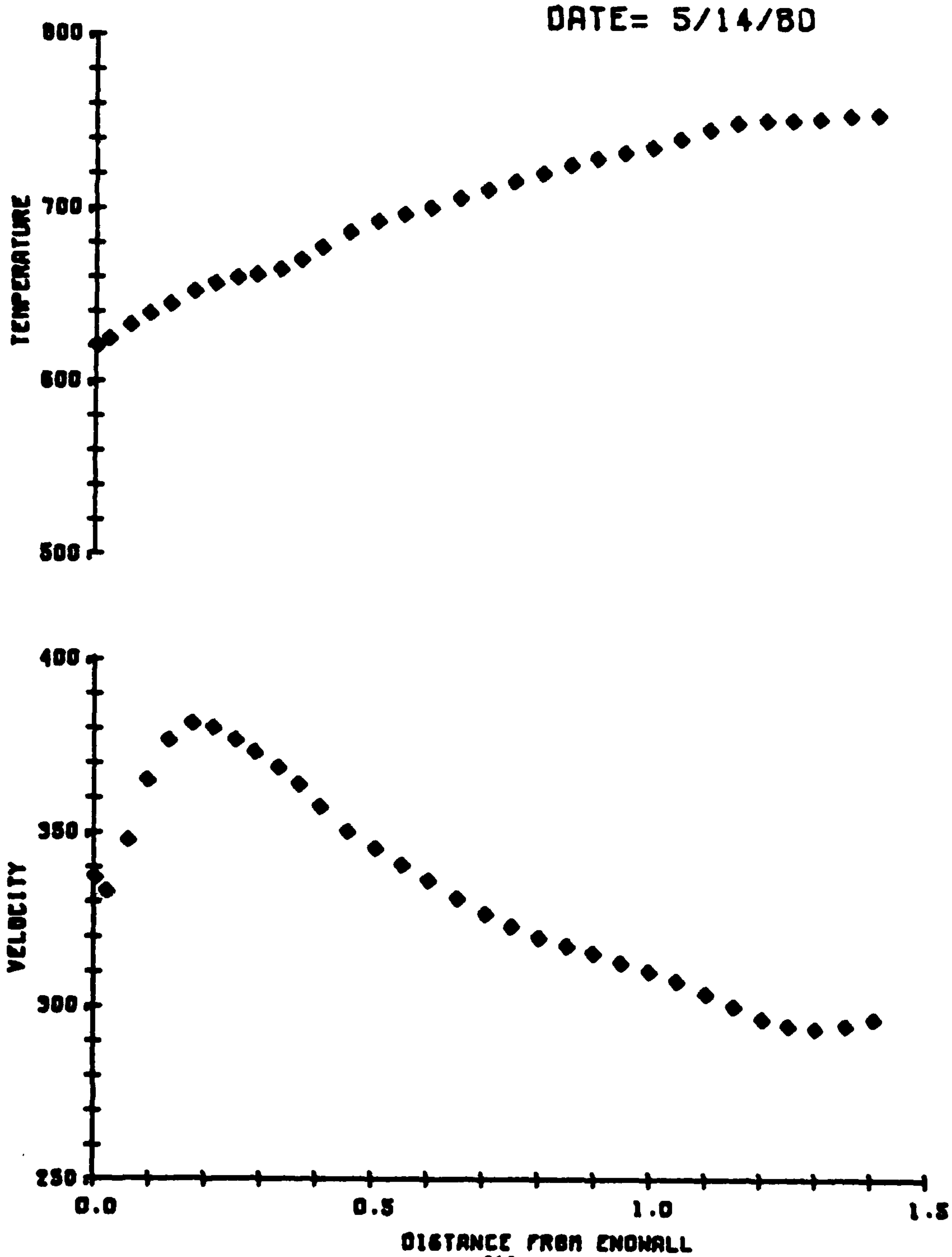
***	LEGEND F (E-06)	***
A	7000.00	
B	6000.00	
C	5000.00	
D	4000.00	
E	2999.99	
F	1999.99	
G	999.99	
MAX	7954.69	

RUN 166 M2 .7 TGAS 800 RE2 1.66E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 16:40:37 80/172

ENDWALL HEAT TRANSFER LINEAR CASCADE

RUN #= 166

DATE= 5/14/80



GMA 200 TURBINE VANE CASCADE

RUN #166 DATE: 5/16/80 TIME: 6:23:20

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
62.21	61.93	1238.01	.060	.087	.255

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.78256	5897160.	776.89

CP - BTU/LBM/F
.256

MASS FLOW RATE

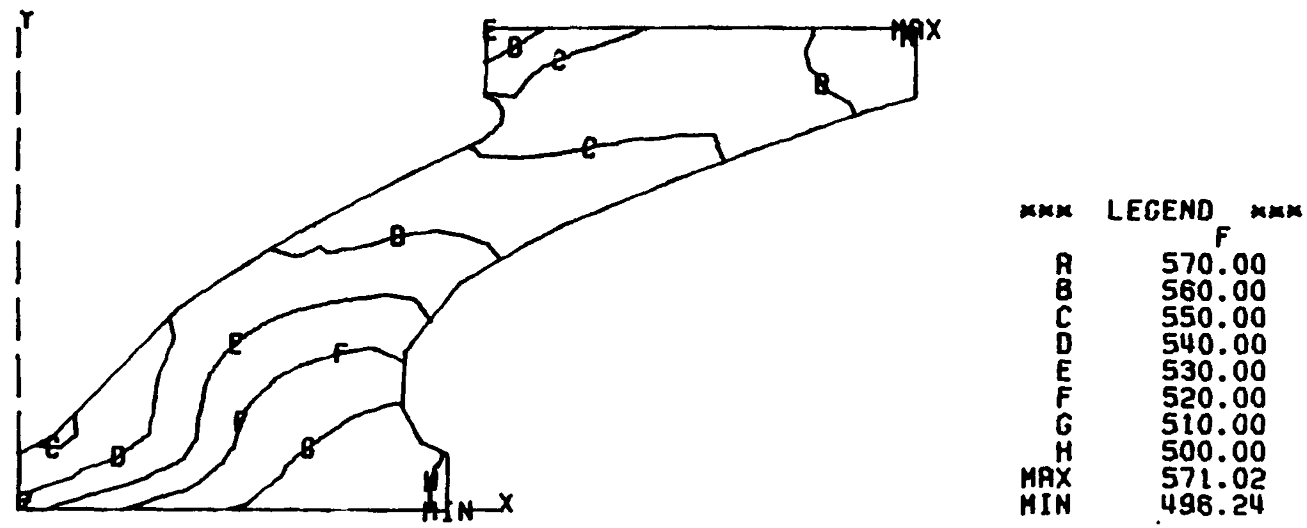
ORIFICE 5.02 CASCADE

IDEAL EXIT CONDITIONS

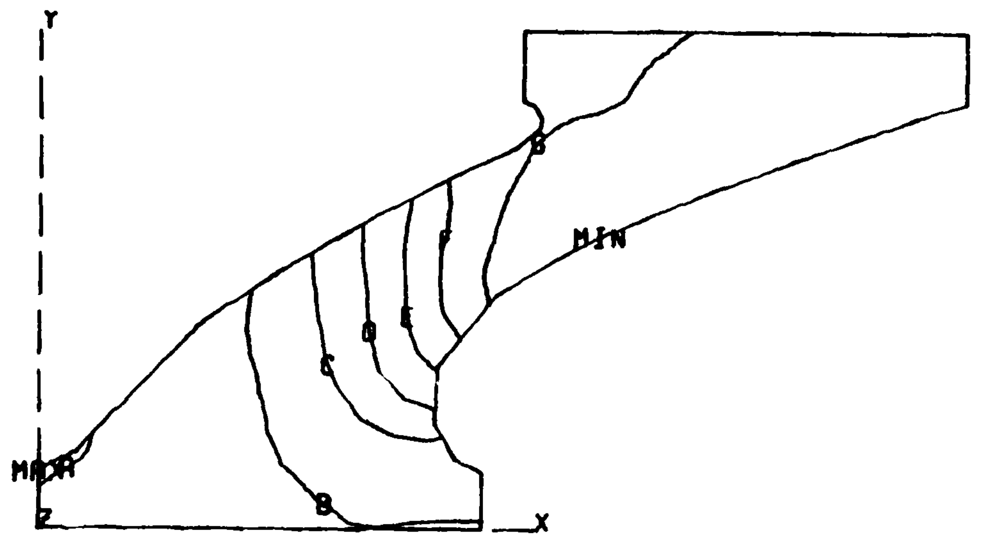
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
62.21	58.48	1238.01	.302	.326	.923

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.064 STATIC PRESSURE RATIO= .944

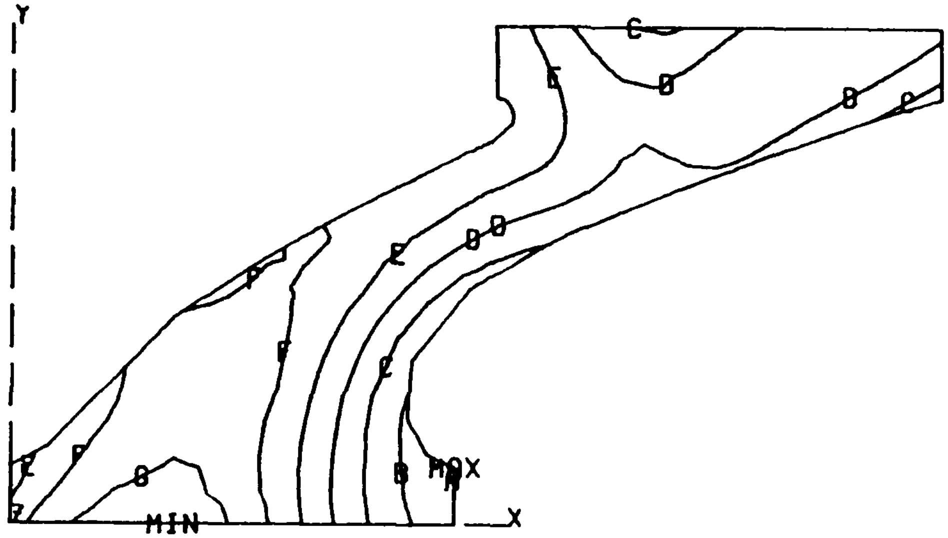


RUN 168 M2 .3 TGAS 800 RE2 .9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 18:16:36 80/144



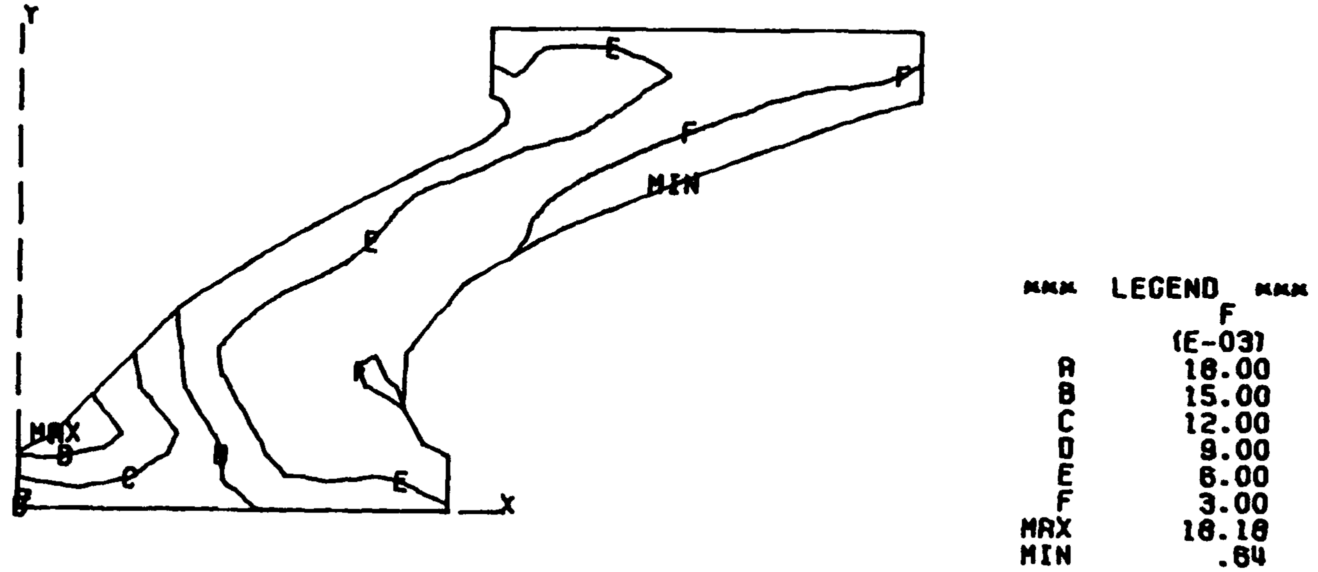
***	LEGEND	***
	PSI	
	(E-03)	
A	62899.96	
B	62199.95	
C	61499.94	
D	60799.93	
E	60099.91	
F	59399.90	
G	58699.89	
MAX	62975.63	
MIN	58193.57	

RUN 168 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 8:17:16 80/179



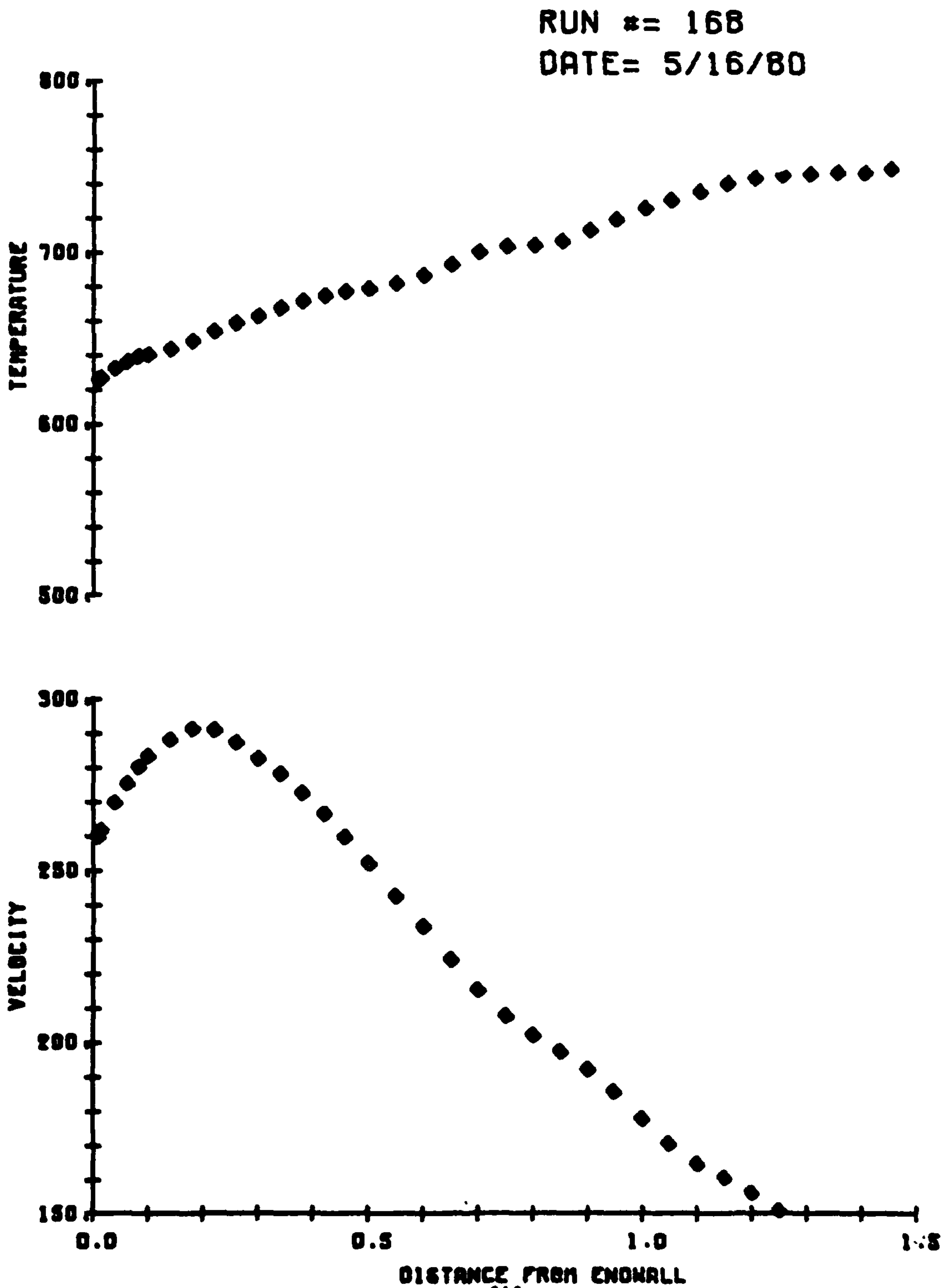
*** LEGEND ***	F
A	636.00
B	630.00
C	624.00
D	618.00
E	612.00
F	606.00
G	600.00
MAX	636.84
MIN	595.13

RUN 168 M2 .3 TGAS 800 RE2 .9E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 9:33:56 81/047



RUN 168 M2 .3 TGAS 800 RE2 .9E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 18:17:26 80/144

ENDWALL HEAT TRANSFER LINEAR CASCADE



GMA 200 TURBINE VANE CASCADE

RUN #169 DATE: 5/26/80 TIME: 7:11:47

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
43.27	42.27	1249.27	.186	.201	.401

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.53194	13665990.	781.81

CP - BTU/LBM/F
.256

MASS FLOW RATE

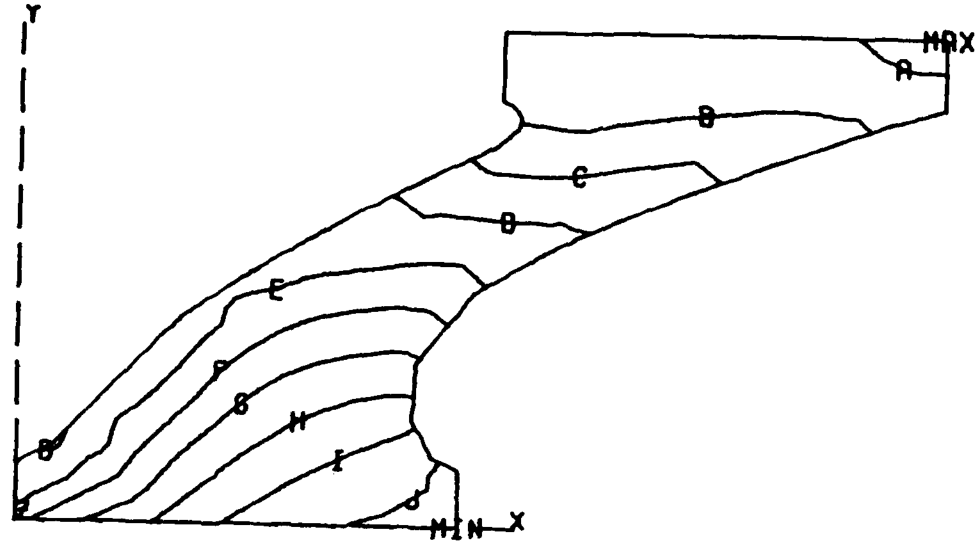
ORIFICE 6.45 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
43.27	31.64	1249.27	.692	.721	1.222

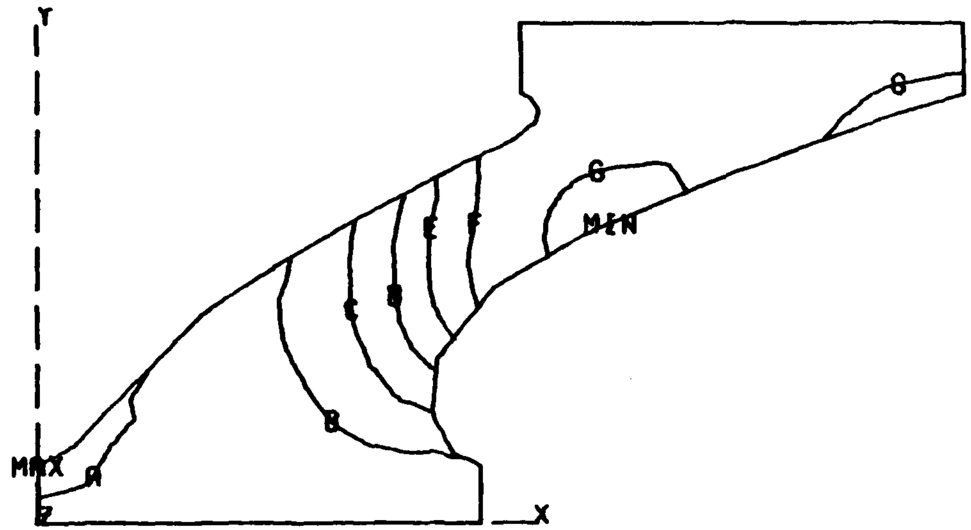
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.368 STATIC PRESSURE RATIO= .748



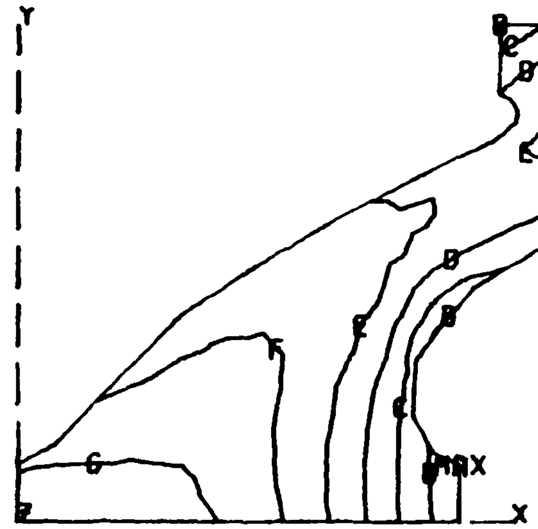
*** LEGEND ***	F
A	590.00
B	580.00
C	570.00
D	560.00
E	550.00
F	540.00
G	530.00
H	520.00
I	510.00
J	500.00
MAX	595.37
MIN	494.61

RUN 169 M2=.7 TGAS=800 RE2=1.2E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:54:47 80/150



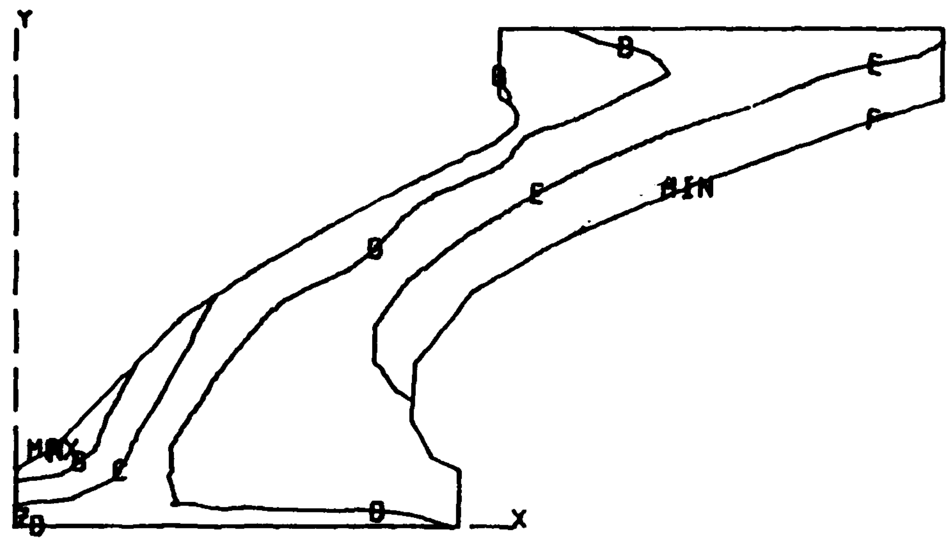
*** LEGEND ***	PSI
A	43.00
B	41.00
C	39.00
D	37.00
E	35.00
F	33.00
G	31.00
MAX	43.21
MIN	30.33

RUN 169 MACH .7 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:34:28 80/169



*** LEGEND ***	F
A	703.00
B	697.00
C	691.00
D	685.00
E	679.00
F	673.00
G	667.00
MAX	703.04
MIN	662.33

RUN 169 M2 .7 TGAS 800 RE2 1.2E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 12:37:06 80/177



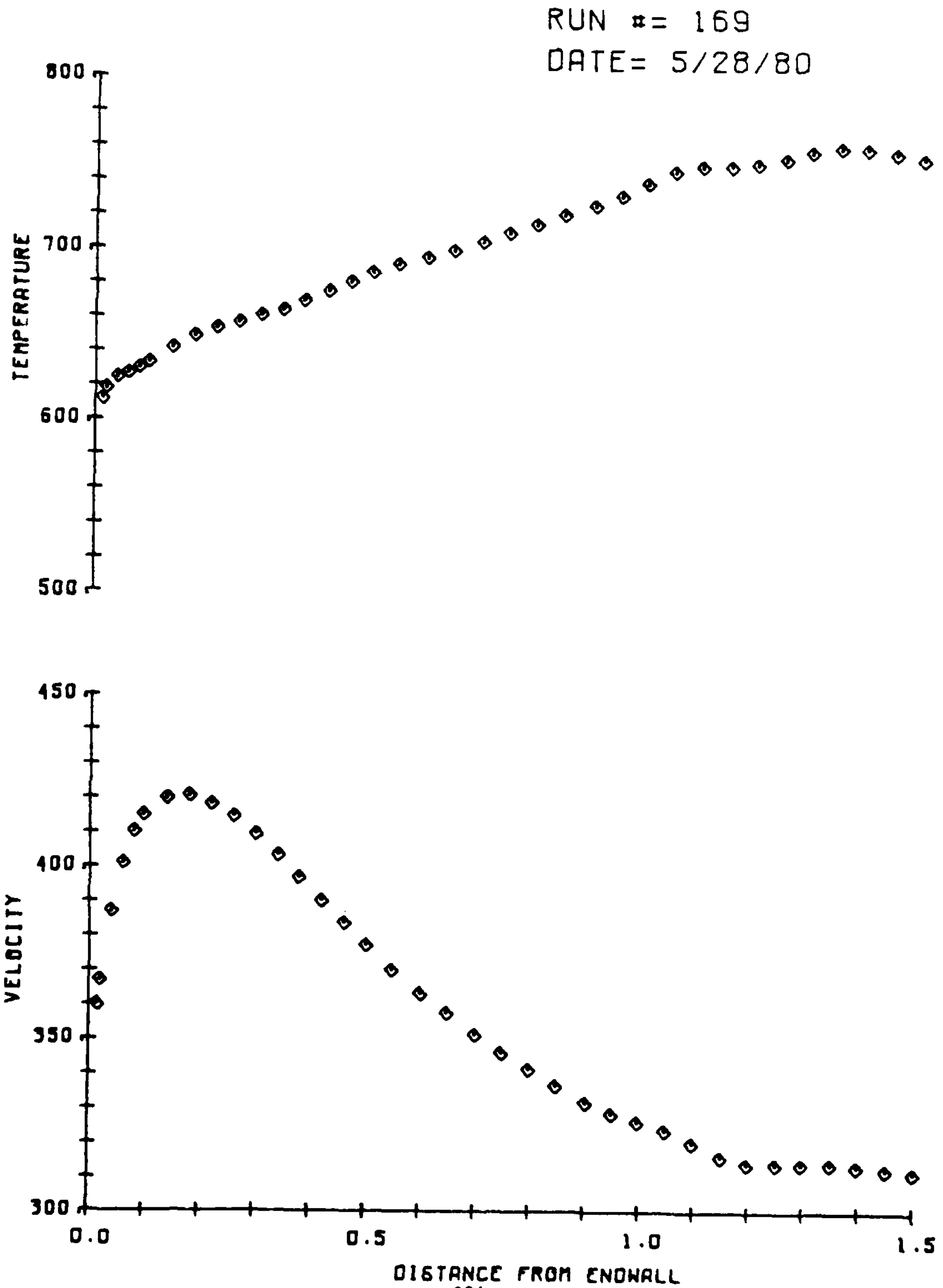
***	LEGEND	***
	F	
	(E-03)	
A	10.00	
B	8.00	
C	6.00	
D	4.00	
E	2.00	
MAX	10.27	

RUN 189 M2=.7 TGAS=800 RE2=1.2E06 HEAT TRANSFER ENDWALL

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 12:55:30 80/150

ENDWALL HEAT TRANSFER LINEAR CASCADE



GMA 200 TURBINE VANE CASCADE

RUN #170 DATE: 5/30/80 TIME: 7:27:26

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
56.64	54.83	1277.69	.219	.237	.600

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.67631	16294938.	806.99

CP - BTU/LBM/F
.257

MASS FLOW RATE

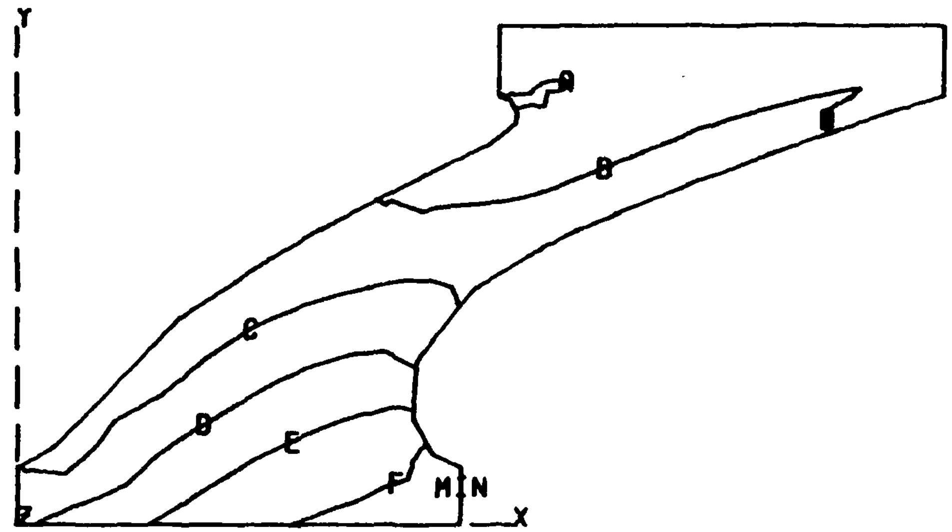
ORIFICE 9.56 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
56.64	28.05	1277.69	1.065	1.054	1.830

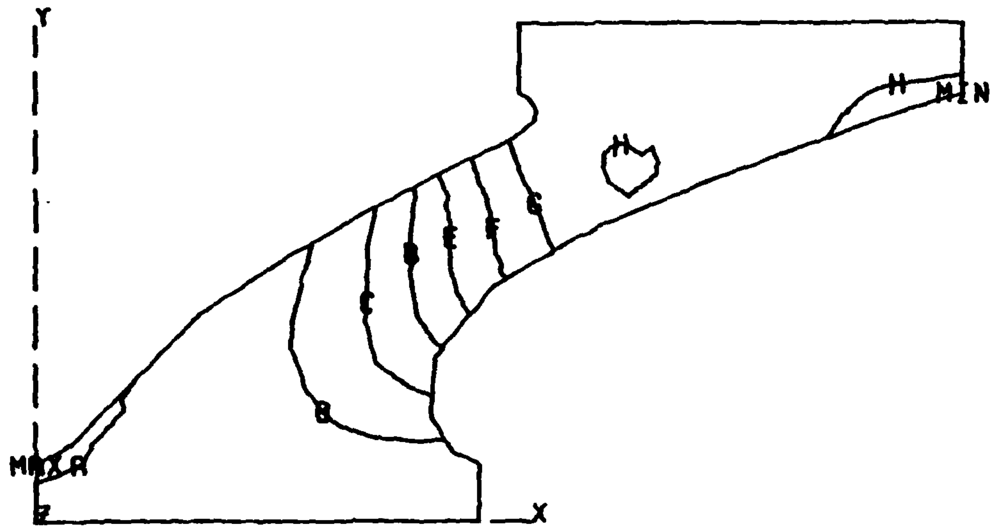
CASCADE OPERATING CONDITION

EXPANSION RATIO= 2.019 STATIC PRESSURE RATIO= .512



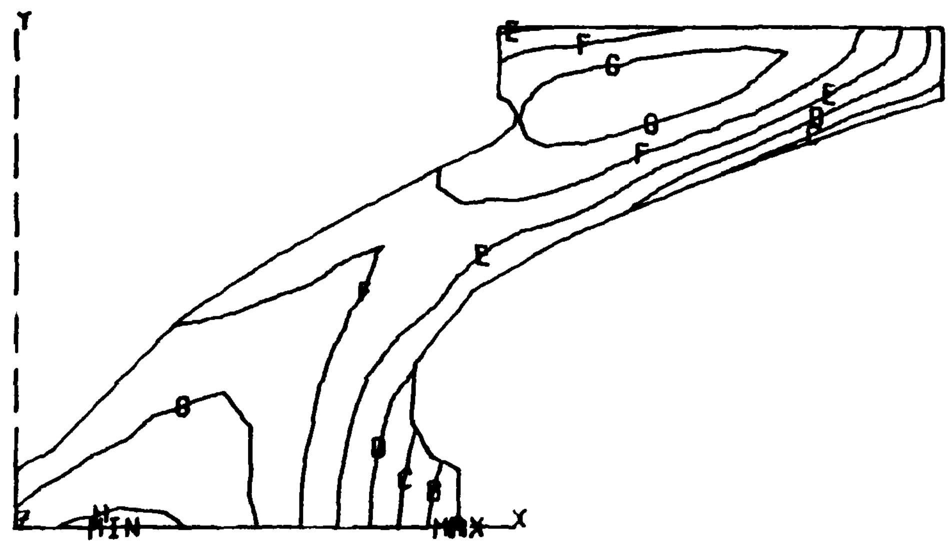
LEGEND	F
A	620.00
B	600.00
C	580.00
D	560.00
E	540.00
F	520.00
MAX	620.44
MIN	504.95

RUN 170 M2 1.0G TGAS 800 RE2 1.8E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE - 1.0000 PLOT TIME AND DATE - 20:45:14 81/085



***	LEGEND	***
	PSI	
A	56.00	
B	52.00	
C	48.00	
D	44.00	
E	40.00	
F	36.00	
G	32.00	
H	28.00	
MAX	56.22	
MIN	26.57	

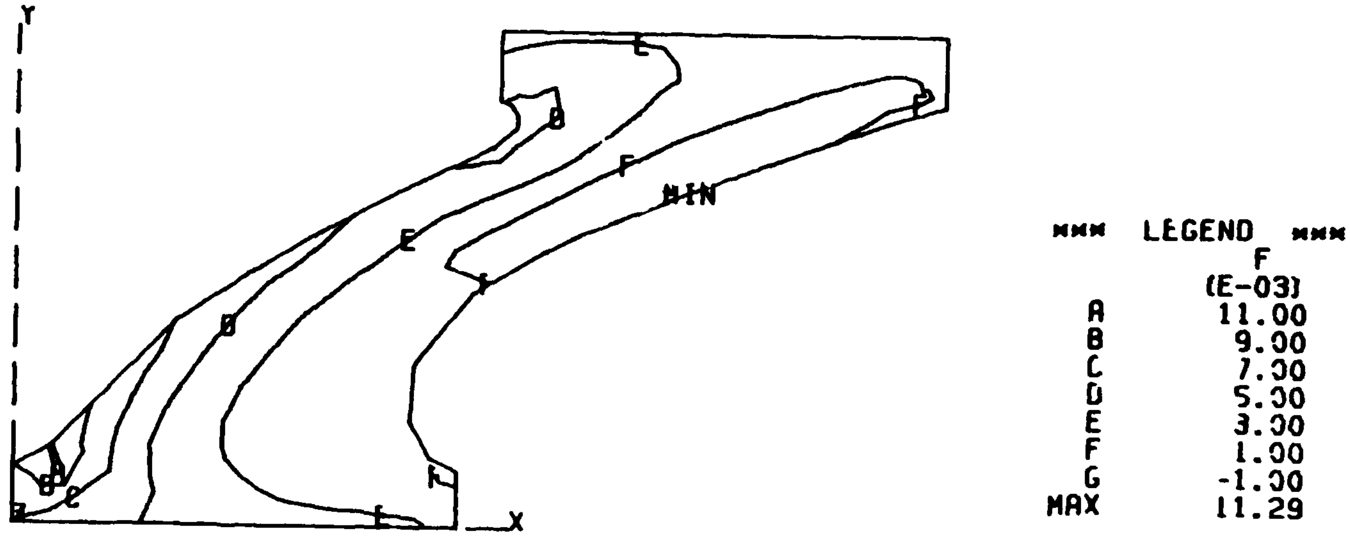
RUN 170 MACH 1.07 TGAS 800 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:47:24 80/169



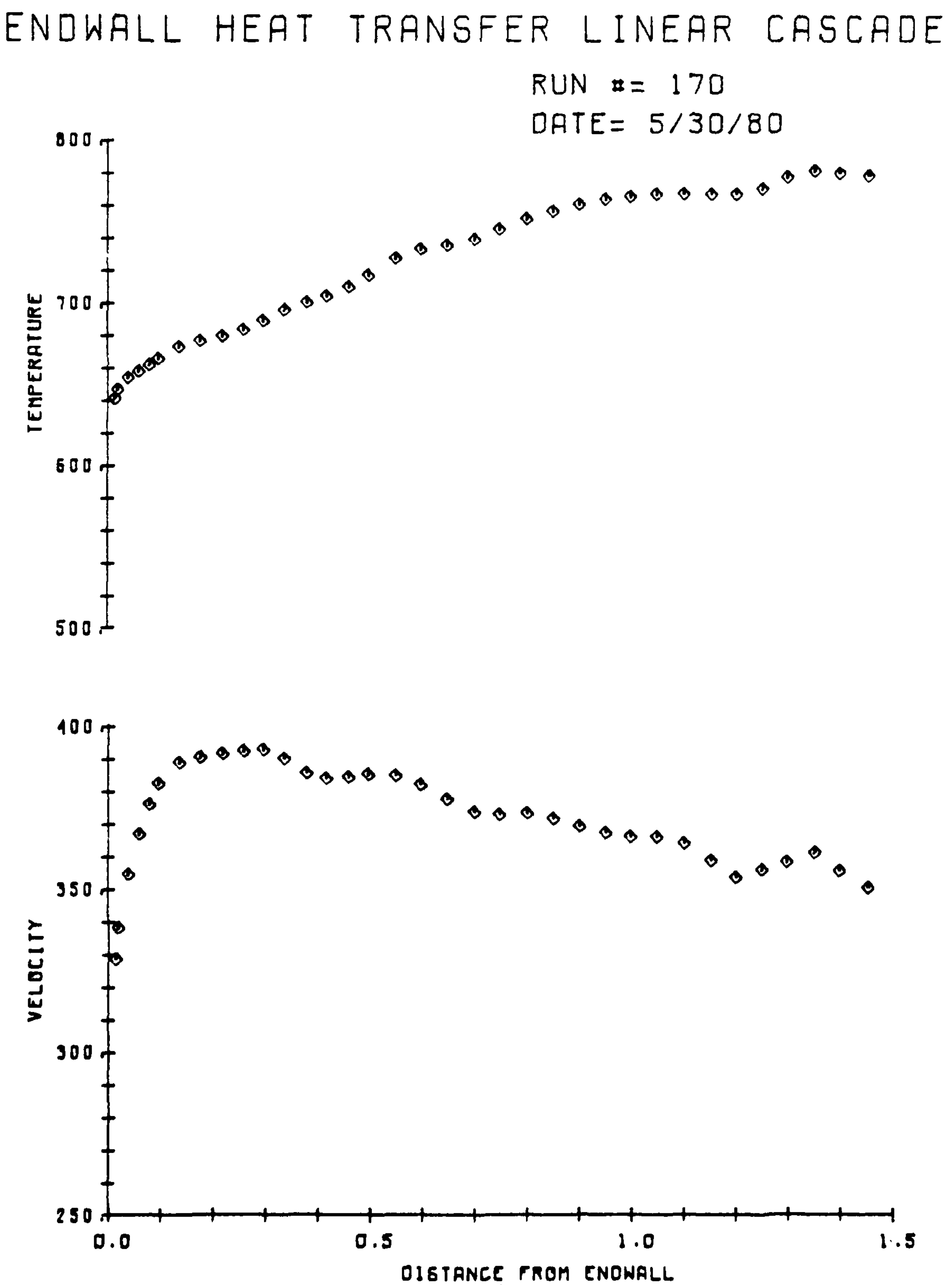
*** LEGEND ***

	F
A	699.00
B	693.00
C	687.00
D	681.00
E	675.00
F	669.00
G	663.00
H	657.00
MAX	699.76
MIN	655.09

RUN 170 M2 1.06 TGAS 800 RE2 1.8E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 8:13:13 80/170



RUN 170 M2 1.06 TGAS 800 RE2 1.8E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 20:46:14 81/085


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 170
DATE= 5/30/80
800
700
600
500
TEMPERATURE
400
350
300
250
VELOCITY
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

GMA 200 TURBINE VANE CASCADE

RUN #171 DATE: 6/9/80 TIME: 7:20: 9

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
56.07	53.78	1266.32	.248	.268	.675

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.67094	18355352.	792.64

CP - BTU/LBM/F
.257

MASS FLOW RATE

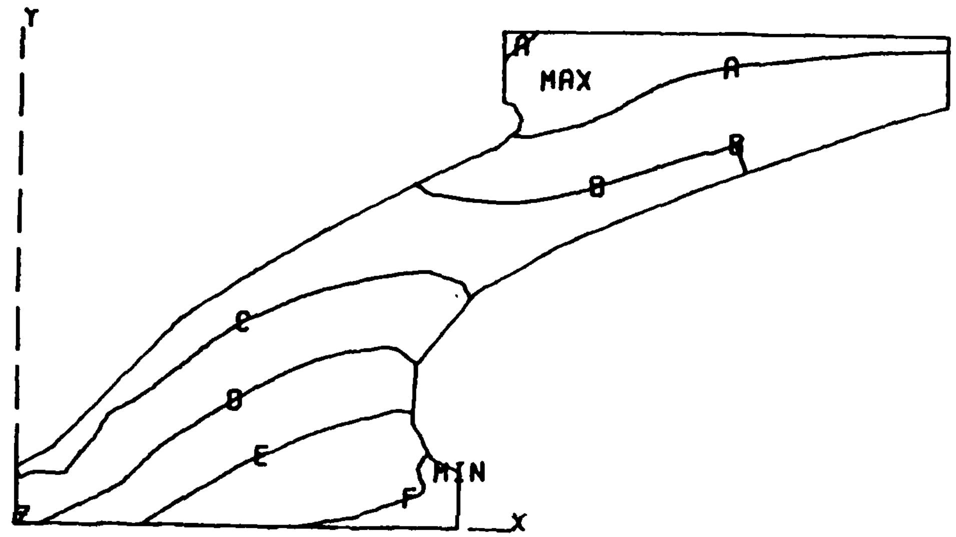
ORIFICE 9.28 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
56.07	28.07	1266.32	1.056	1.046	1.829

CASCADE OPERATING CONDITION

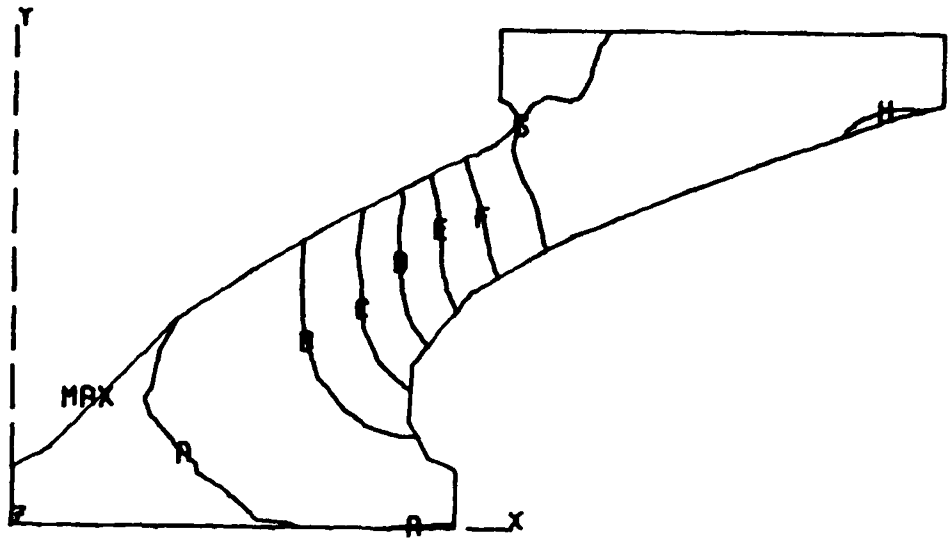
EXPANSION RATIO= 1.997 STATIC PRESSURE RATIO= .522



*** LEGEND ***

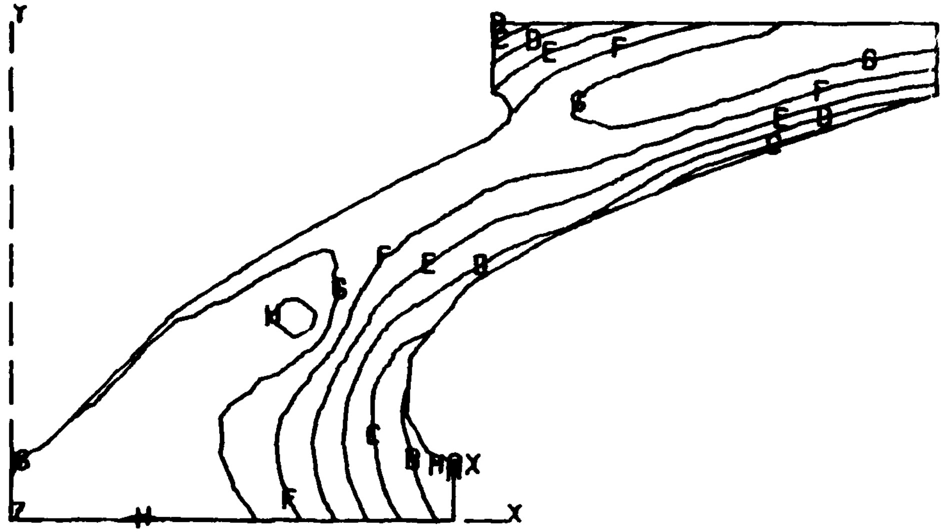
	F
A	630.00
B	610.00
C	590.00
D	570.00
E	550.00
F	530.00
MAX	636.52
MIN	521.25

RUN 171 MACH 1.05E06 TGAS 800 RE2 1.8E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:40:11 80/171



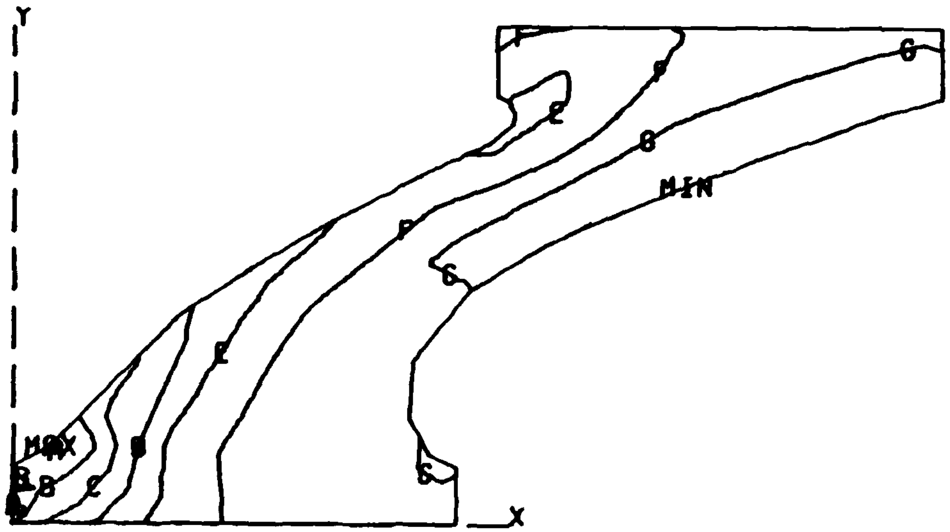
*** LEGEND ***	PSI
A	54.00
B	50.00
C	46.00
D	42.00
E	38.00
F	34.00
G	30.00
H	26.00
MAX	54.92
MIN	25.51

RUN 171 MACH 1.05E06 TGAS 800 RE2 1.8E06 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:22:39 80/163



*** LEGEND ***	F
A	710.00
B	703.00
C	696.00
D	689.00
E	682.00
F	675.00
G	668.00
H	661.00
MAX	710.37
MIN	658.44

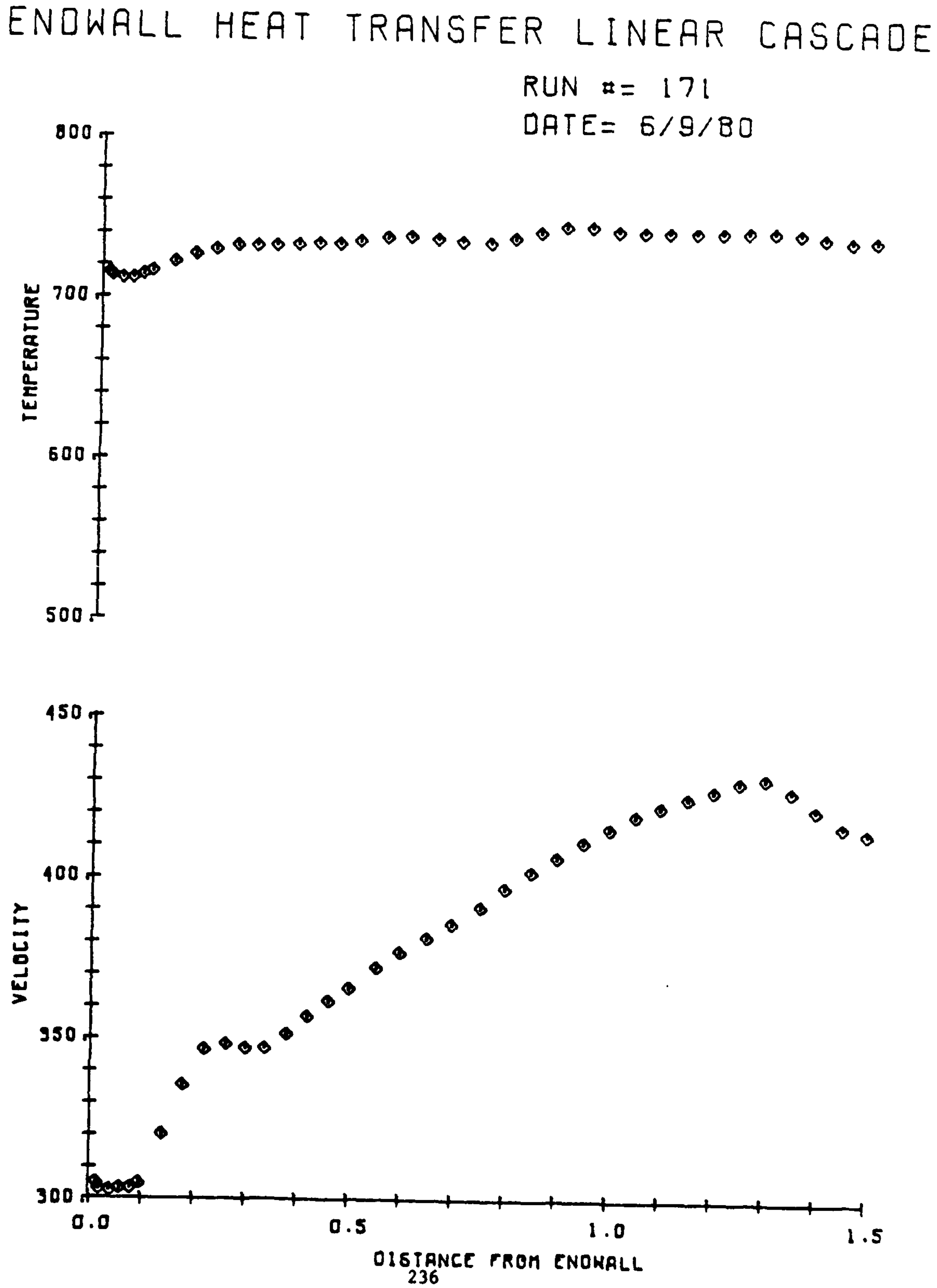
RUN 171 MACH 1.05E06 TGAS 800 RE2 1.8E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 14:50:15 80/170



*** LEGEND ***

	F (E-03)
A	13.00
B	11.00
C	9.00
D	7.00
E	5.00
F	3.00
G	1.00
MAX	13.58

RUN 171 MACH 1.05E06 TGAS 800 RE2 1.8E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 17:40:34 80/171


ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 171
DATE= 6/9/80
800
700
600
500
TEMPERATURE
450
400
350
300
VELOCITY
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

GMA 200 TURBINE VANE CASCADE

RUN #172 DATE: 6/11/80 TIME: 4:21: 3

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
33.87	32.83	1259.67	.214	.232	.356

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.41064	15805562.	789.60

CP - BTU/LBM/F
.257

MASS FLOW RATE

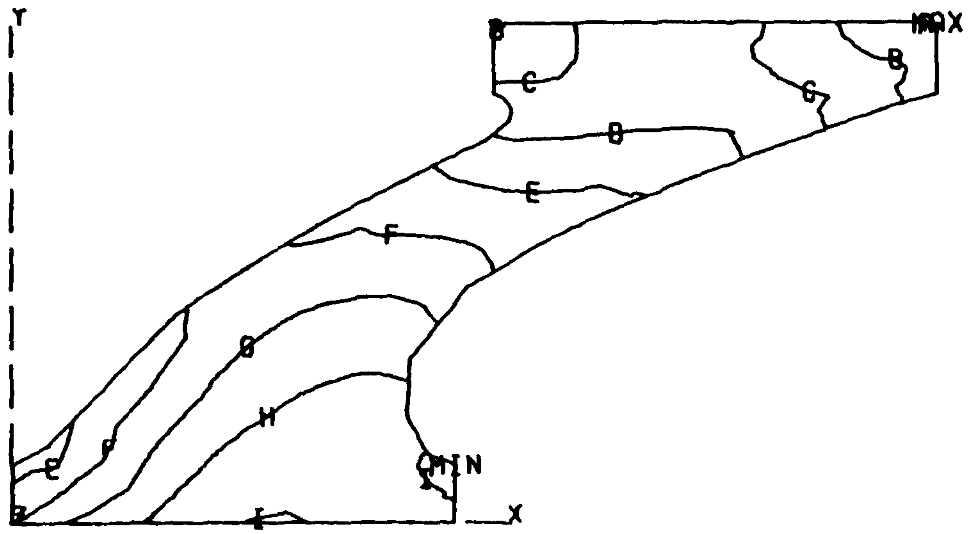
ORIFICE 5.03 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
33.87	24.50	1259.67	.704	.733	.957

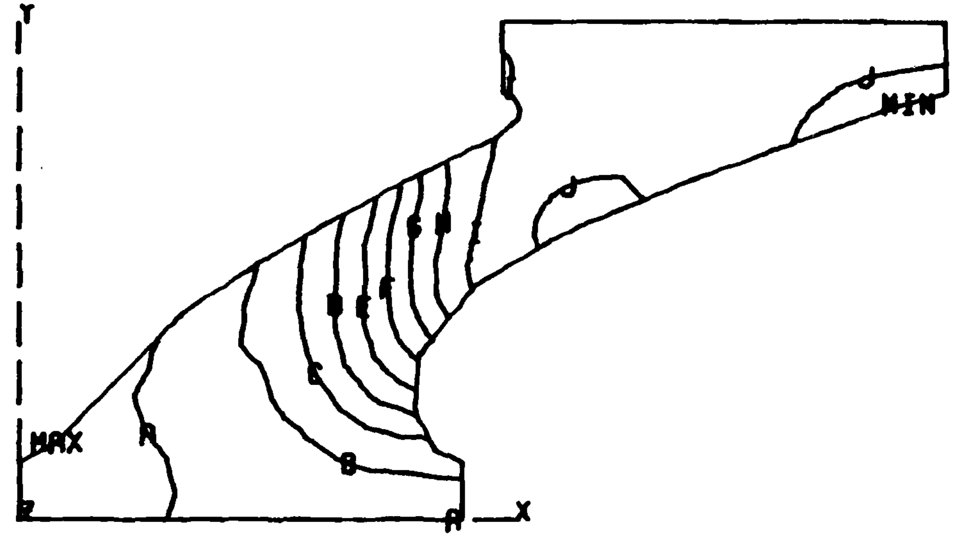
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.382 STATIC PRESSURE RATIO= .746



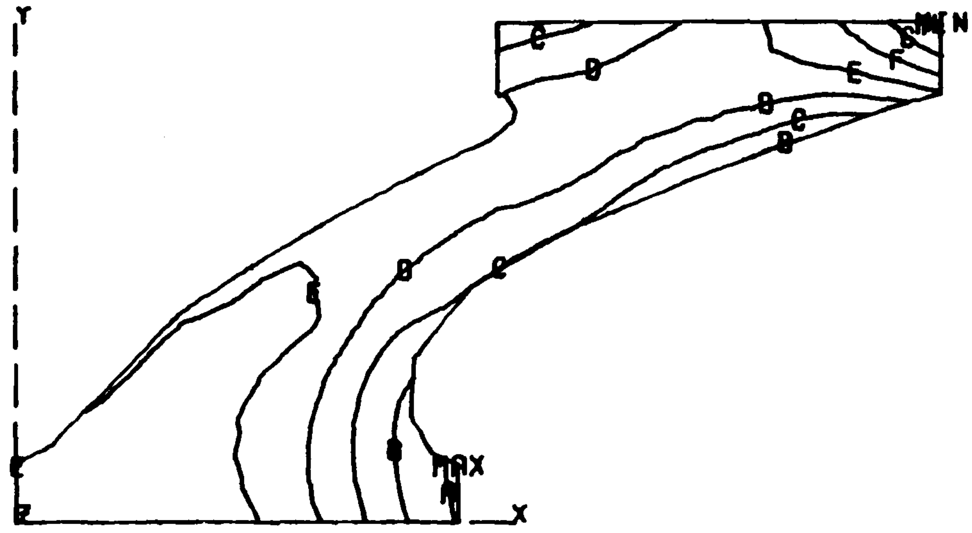
*** LEGEND ***	F
A	580.00
B	570.00
C	560.00
D	550.00
E	540.00
F	530.00
G	520.00
H	510.00
I	500.00
MAX	581.35
MIN	498.92

RUN 172 MACH.7 TGAS 800 RE2 .96E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 7:51:10 80/171



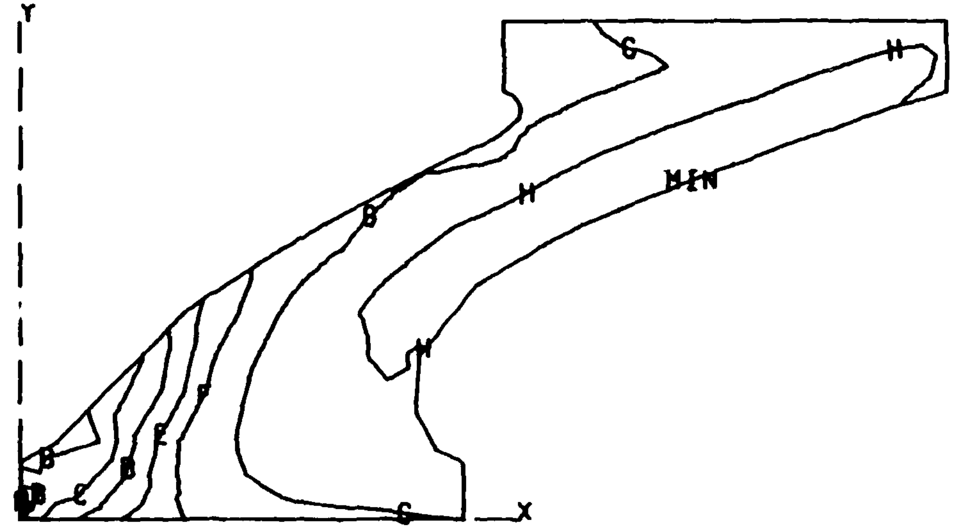
*** LEGEND ***	PSI
A	33.00
B	32.00
C	31.00
D	30.00
E	29.00
F	28.00
G	27.00
H	26.00
I	25.00
J	24.00
MAX	33.31
MIN	23.22

RUN 172 MACH.7 TGAS 800 RE2 .96E06 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:32:43 80/163



***	LEGEND ***
	F
A	730.00
B	720.00
C	710.00
D	700.00
E	690.00
F	680.00
G	670.00
H	660.00
MAX	732.81
MIN	655.81

RUN 172 MACH.7 TGAS 800 RE2 .96E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:10:09 80/170

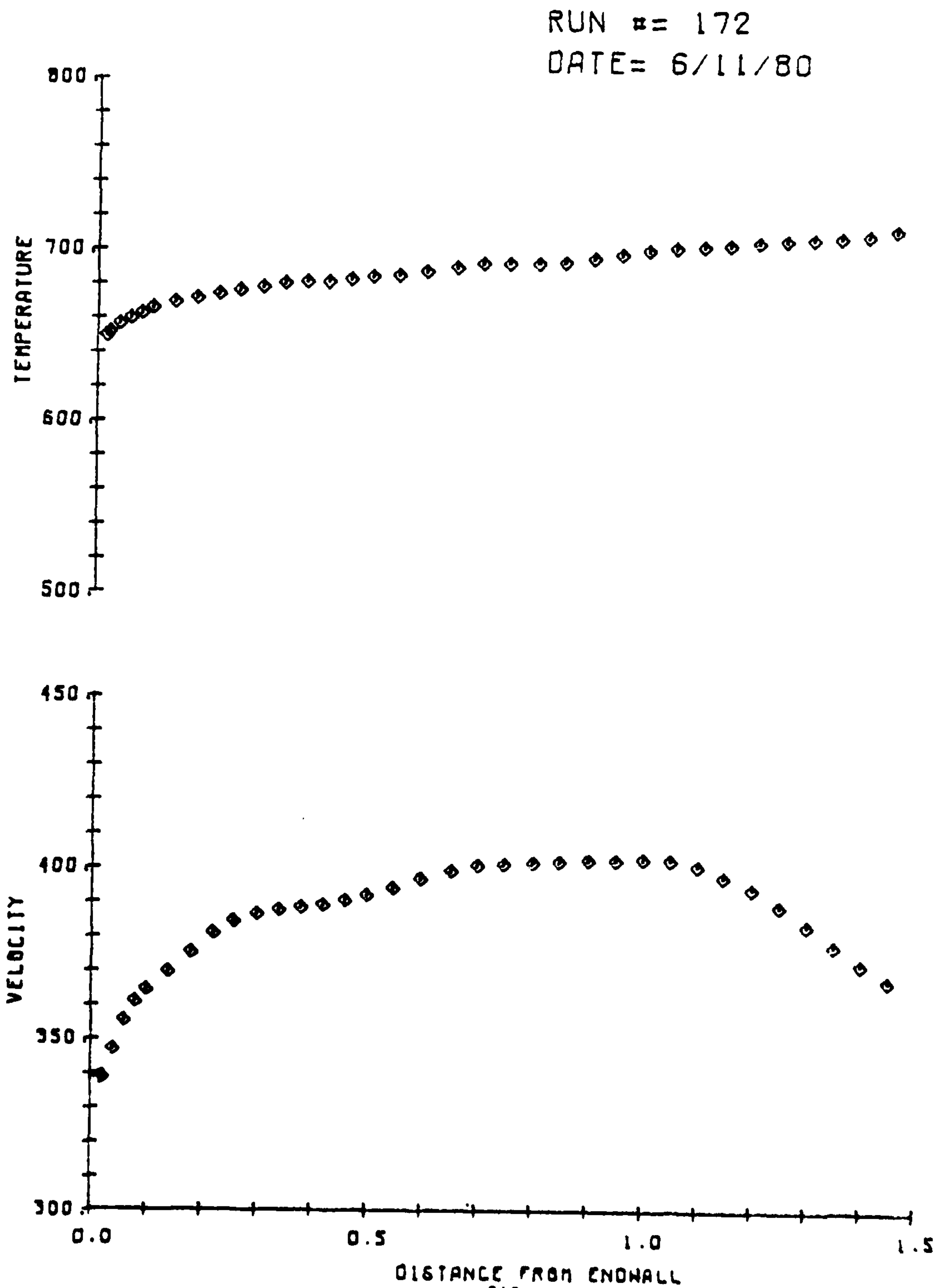


*** LEGEND ***

	F (E-03)
A	16.00
B	14.00
C	12.00
D	10.00
E	8.00
F	6.00
G	4.00
H	2.00
MAX	16.09

RUN 172 MACH.7 TGAS 800 RE2 .96E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 7:51:34 80/171

ENDWALL HEAT TRANSFER LINEAR CASCADE



GMA 200 TURBINE VANE CASCADE

RUN #173 DATE: 6/11/80 TIME: 10:45:29

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
45.23	43.73	1243.55	.223	.241	.503

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.55437	16373602.	772.70

CP - BTU/LBM/F
.256

MASS FLOW RATE

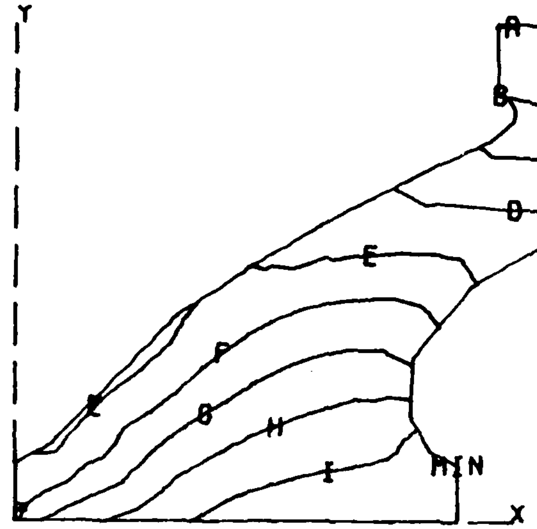
ORIFICE 6.42 CASCADE

IDEAL EXIT CONDITIONS

PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
45.23	32.70	1243.55	.705	.734	1.298

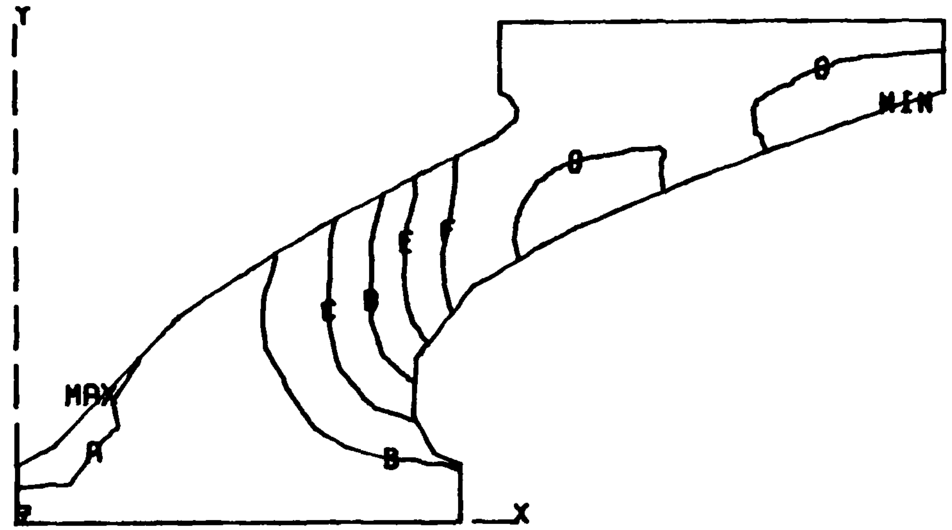
CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.383 STATIC PRESSURE RATIO= .748



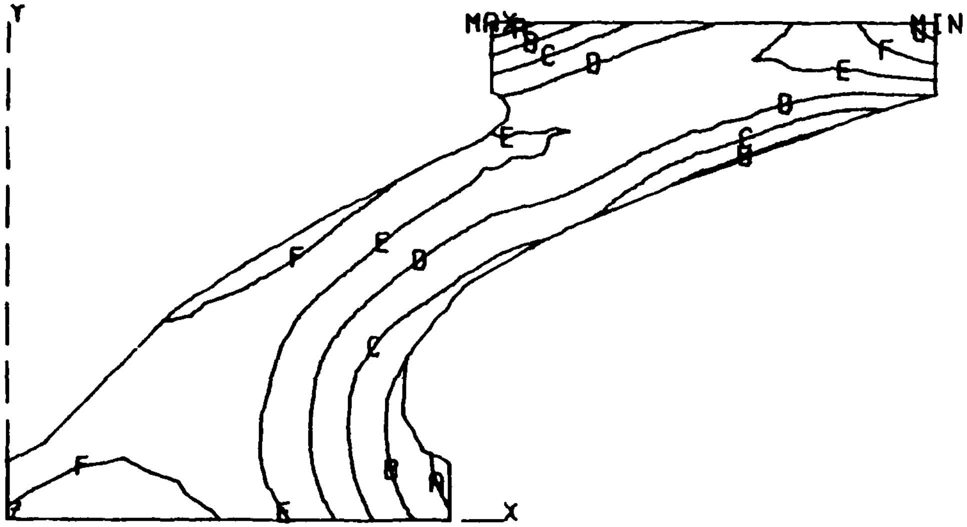
*** LEGEND ***	F
A	580.00
B	570.00
C	560.00
D	550.00
E	540.00
F	530.00
G	520.00
H	510.00
I	500.00
MAX	587.92
MIN	490.42

RUN 173 MACH .7 TGAS 800 RE2 1.25E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 10:18:57 80/172



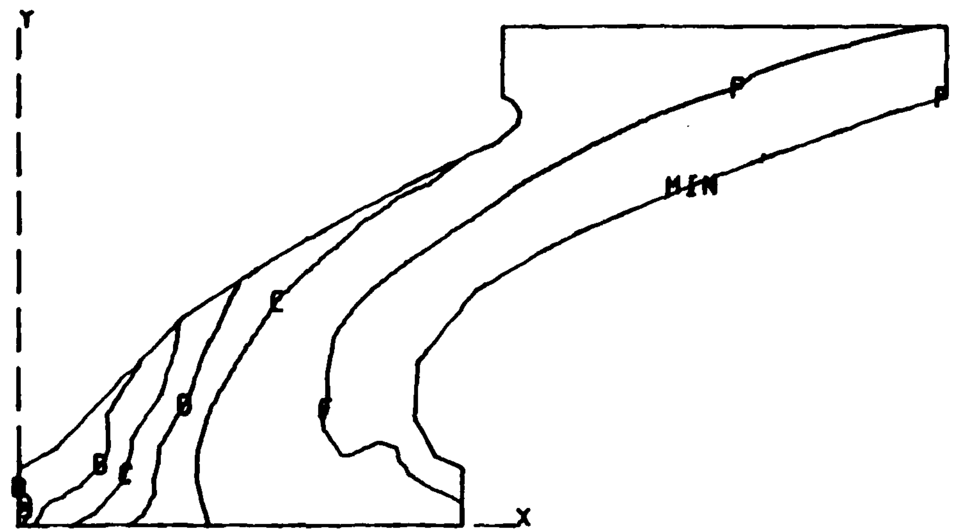
*** LEGEND ***	PSI
A	44.00
B	42.00
C	40.00
D	38.00
E	36.00
F	34.00
G	32.00
MAX	44.23
MIN	30.49

RUN 173 MACH .7 TGAS 800 RE2 1.25E06 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:42:50 80/163



***	LEGEND F ***
A	700.00
B	690.00
C	680.00
D	670.00
E	660.00
F	650.00
G	640.00
MAX	709.06
MIN	634.30

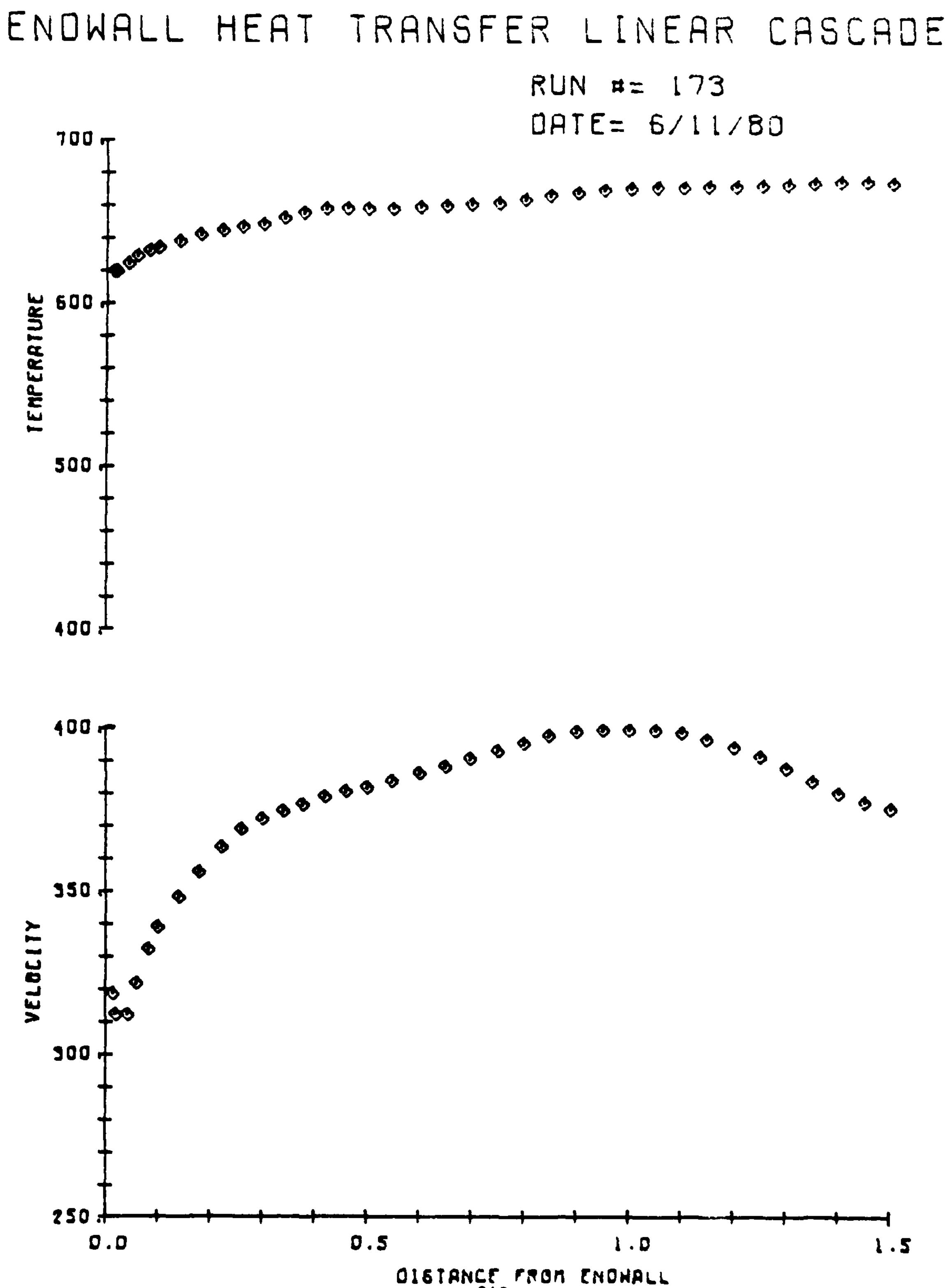
RUN 173 MACH .7 TGAS 800 RE2 1.25E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 16:28:53 80/170



*** LEGEND ***

	F (E-03)
A	12.00
B	10.00
C	8.00
D	6.00
E	4.00
F	2.00
MAX	12.52

RUN 173 MACH .7 TGAS 800 RE2 1.25E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 1.0000 PLOT TIME AND DATE = 10:19:19 80/172



ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 173
DATE= 6/11/80
TEMPERATURE
700
600
500
400
VELOCITY
400
350
300
250
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

GMA 200 TURBINE VANE CASCADE

RUN #174 DATE: 6/13/80 TIME: 4:19:32

INLET CONDITIONS

PTOTLE	PSTATIC	TTOTLE	MACH #	V/V*	REY/10**6
58.93	56.87	1255.88	.229	.247	.663

STANTON CALCULATION INPUT

RHO -LBM/IN3 *10**4	VELOCITY - IN/HR	STREAM TEMPERATURE - F
.71427	16855192.	784.38

CP - BTU/LBM/F
.257

MASS FLOW RATE

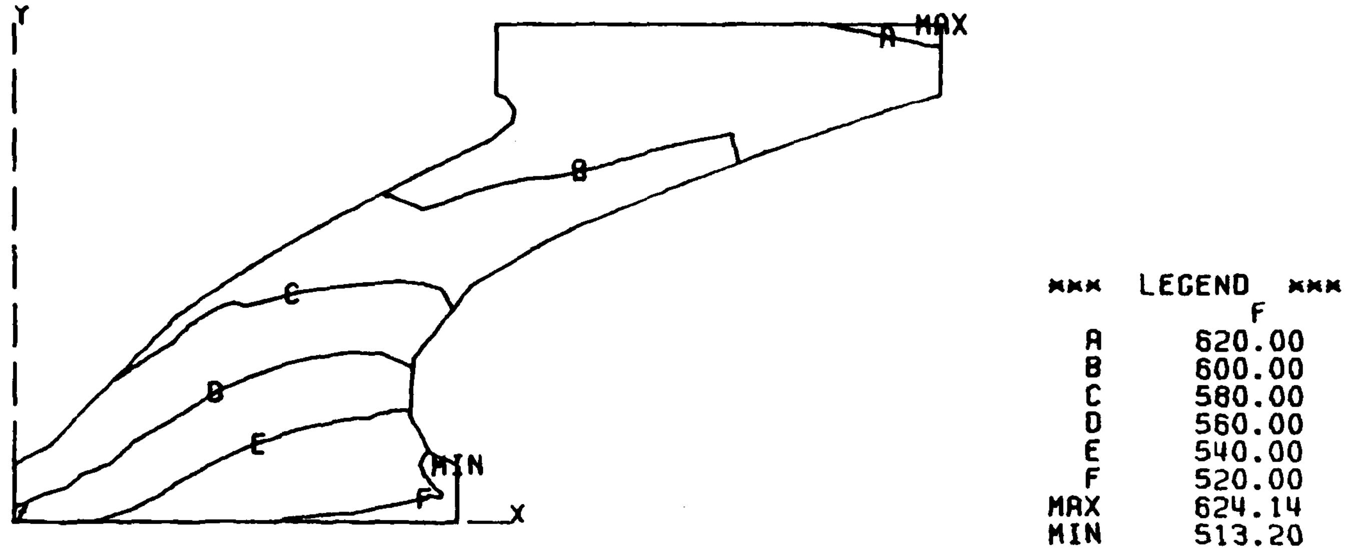
ORIFICE 8.92 CASCADE

IDEAL EXIT CONDITIONS

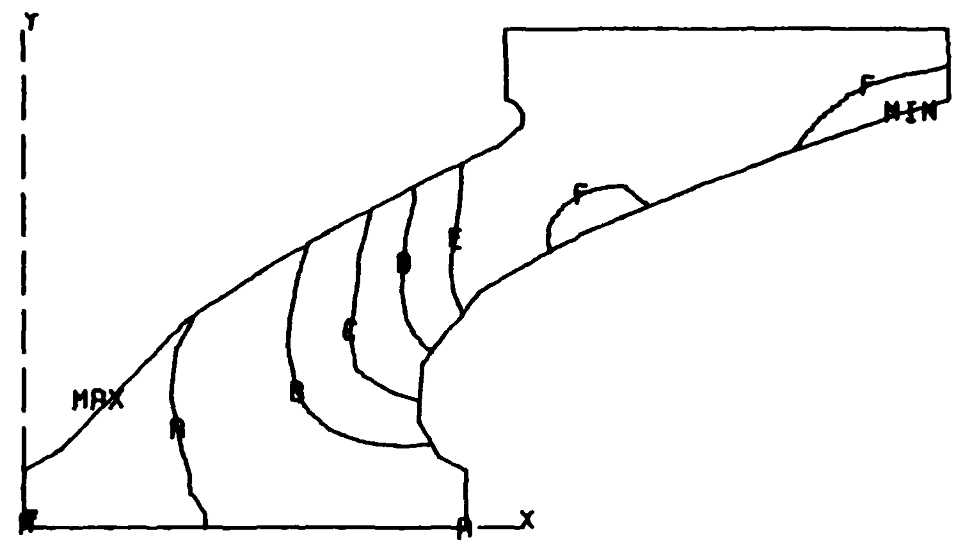
PTOTLE	STATIC	TTOTAL	MACH #	V/V*	REY/10**6
58.93	43.03	1255.88	.693	.723	1.656

CASCADE OPERATING CONDITION

EXPANSION RATIO= 1.369 STATIC PRESSURE RATIO= .757

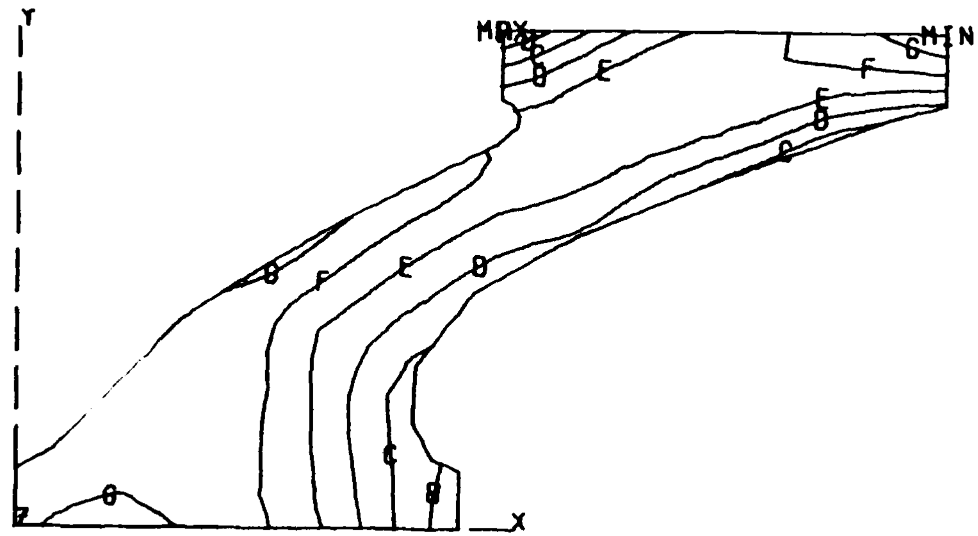


RUN 174 MACH .7 TGAS 800 RE2 1.66E06 HEAT TRANSFER ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 17:44:56 80/170



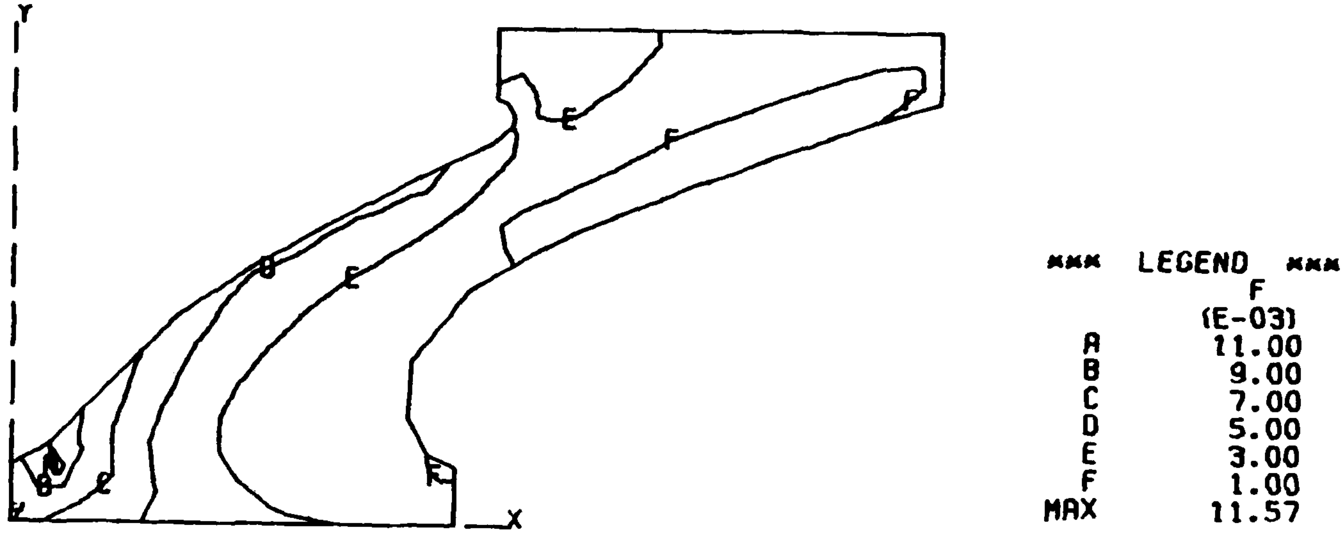
*** LEGEND ***	PSI
A	57.00
B	54.00
C	51.00
D	48.00
E	45.00
F	42.00
MAX	57.66
MIN	39.82

RUN 174 MACH .7 TGAS 800 RE2 1.66E06 ENDWALL PRESSURE CONTOURS
CONTOUR PLOT OF PRESSURE
SCALE = 1.0000 PLOT TIME AND DATE = 15:22:22 80/176



*** LEGEND ***	F
A	694.00
B	685.00
C	676.00
D	667.00
E	658.00
F	649.00
G	640.00
MAX	694.50
MIN	631.50

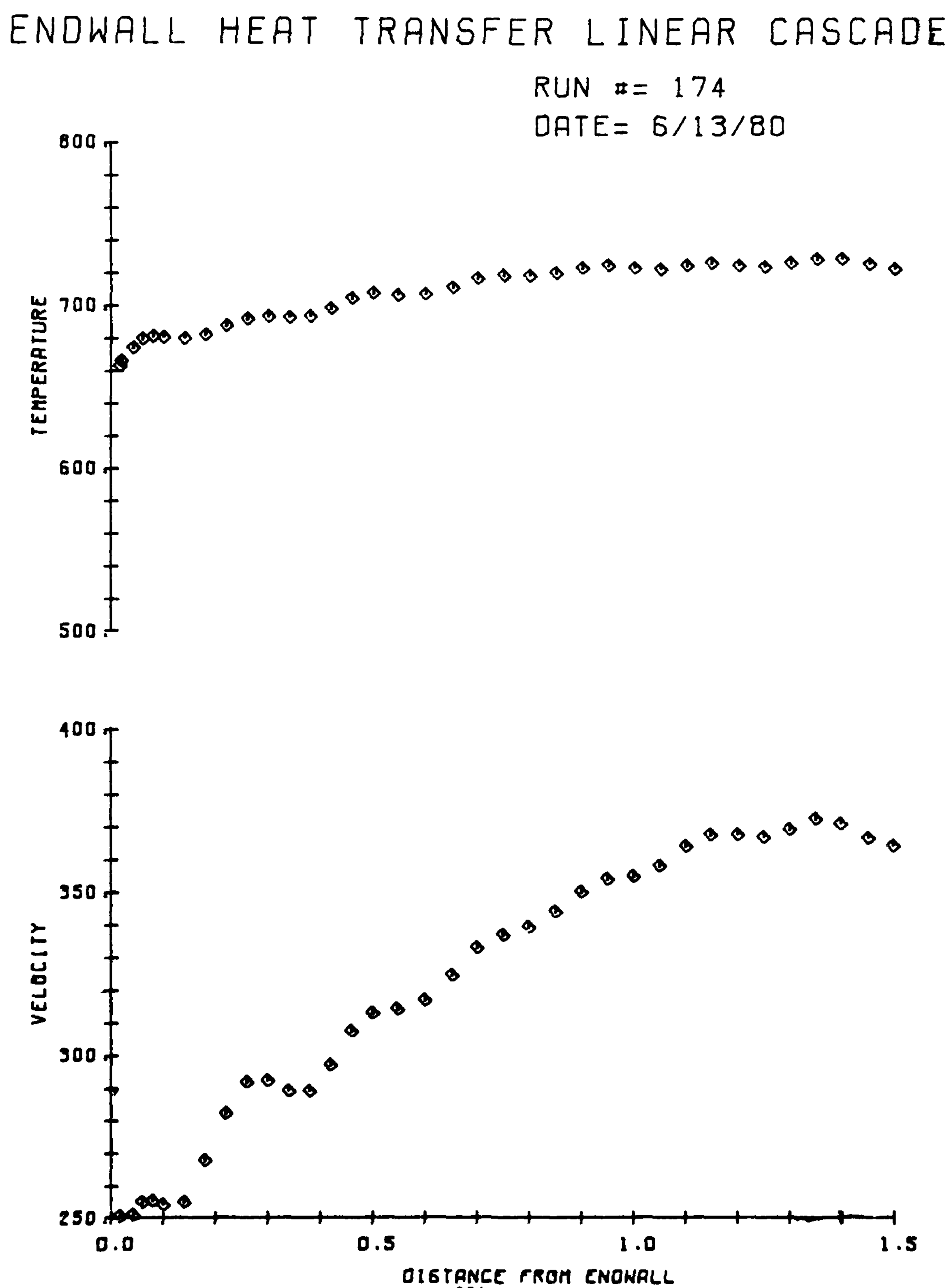
RUN 174 MACH .7 TGAS 800 RE2 1.66E06 ADIABATIC ENDWALL
CONTOUR PLOT OF TEMPERATURE
SCALE = 1.0000 PLOT TIME AND DATE = 14:08:42 80/168



RUN 174 MACH .7 TGAS 800 RE2 1.66E06 HEAT TRANSFER ENDWALL

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 1.0000 PLOT TIME AND DATE = 17:45:19 80/170



ENDWALL HEAT TRANSFER LINEAR CASCADE
RUN #= 174
DATE= 6/13/80
800
700
600
500
TEMPERATURE
400
350
300
250
VELOCITY
0.0
0.5
1.0
1.5
DISTANCE FROM ENDWALL

3.0 ANNULAR CASCADE

The data in this section will include summaries of results from all annular cascade tests. Run conditions are summarized and general descriptions of available types of data plots are given. Availability of specific plots for each run is discussed and then individual plots for each run are presented.

3.1 RUN CONDITIONS

The annular cascade was intended to supply data on the effects of the one important variable that could not be simulated in the linear 2-D cascade, the radial pressure gradient. Determining the effects of the radial pressure gradient required making heat transfer measurements on both the hub and tip endwalls.

Data was taken over a range of exit Mach and Reynolds numbers and at various gas temperatures. Variation in gas temperature provided data over a range of wall-to-gas temperature ratios. Details of the test plan were discussed in Section 4 of Volume I and will not be repeated here. The inlet and exit flow conditions for the annular cascade runs are summarized in Table 4.

3.2 DESCRIPTION OF SUMMARY DATA

The data on the annular cascade was not as extensive as on the linear cascade. Summary contour plots are presented for the hub and tip endwalls, but only hotside temperature contours and Stanton number contours are presented.

As with the linear cascade data, the measured hotside passage temperatures on the endwall were curve fit, with the results then used to obtain interpolated temperatures for the nodes of the finite element model. Separate models were required for the hub and tip, due to the difference in geometry in the 3-D annular cascade. Using the contour plotting capabilities of the finite element program, the interpolated hotside temperatures in °F at each node were then contour plotted for the hub and tip endwalls.

The Stanton number contour plots were developed by using the local endwall heat transfer coefficient that is determined at each node by the finite element solution technique. The Stanton number is calculated at each node based on the heat transfer coefficient at that node and the average inlet flow conditions. These values for both the hub and tip endwalls are then contour plotted by the finite element plotting routine. Because of the sign convention employed in the heat flux measurements, the Stanton numbers on the contour plots are negative. The absolute values should be used. This will result in the reversal of the MAX and MIN locations shown on the contour plots.

The annular cascade exit aero data summary consists of three pages per run. The first page lists tabulated values of the various loss parameters. The different parameters are explained in Section 6 of Volume I. The second page shows a contour plot of the exit air angle and aplot of the mixed-out air angle versus percent span. The final page shows exit pressure loss coefficient contours and mixed-out pressure loss coefficient versus percent span.

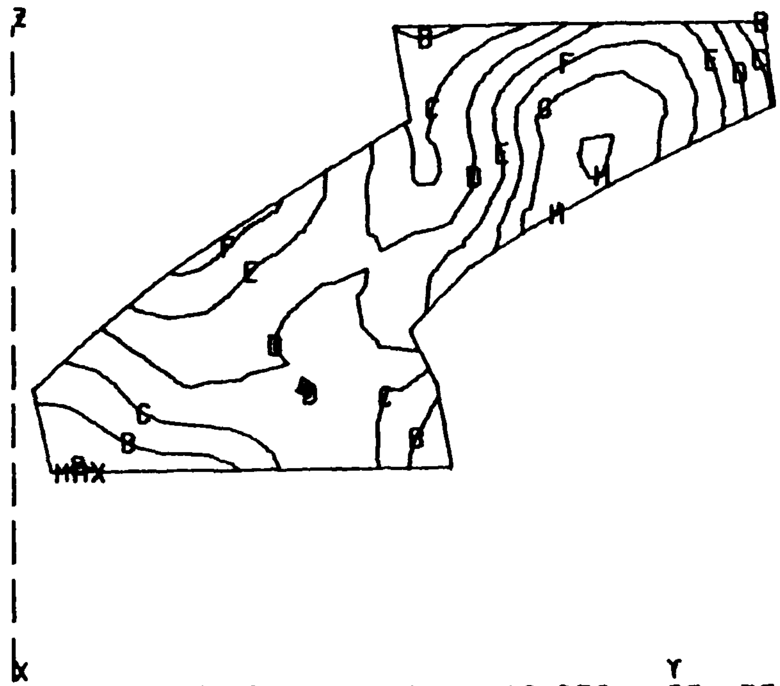
3.3 DATA SUMMARY

This section contains the data summary sheets for all annular cascade runs. Results are presented for each run in the following order: hub heat transfer, tip heat transfer, and exit aero surveys. Runs are arranged in numerical order. Run conditions are given in Table 4.

TABLE 4. ANNULAR CASCADE RUN CONDITIONS

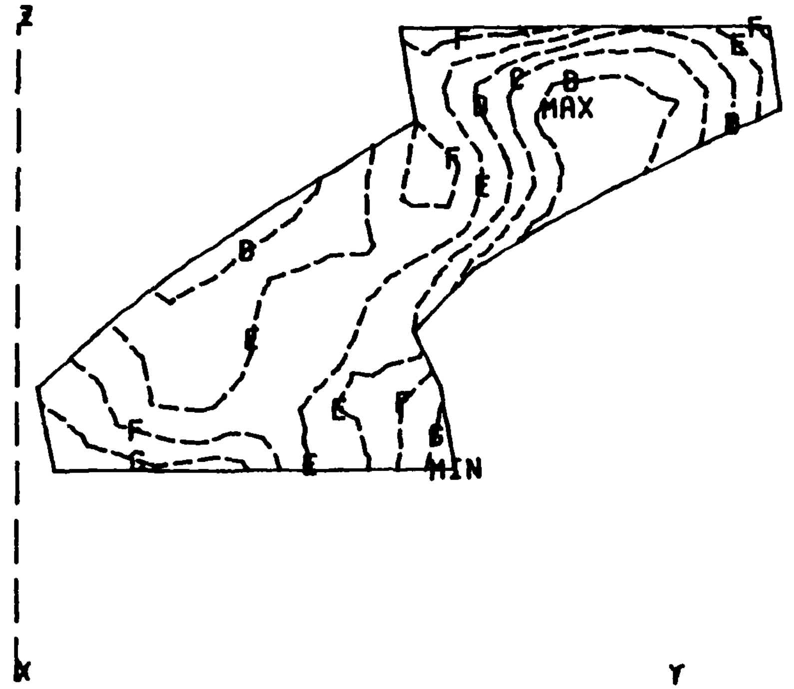
		Inlet conditions				Exit conditions		
Page Nos.	Run No.	Gas total temperature (°F)	Total pressure (psia)	Hub static pressure (psia)	Tip static pressure (psia)	Mach number	Reynolds number x 10^{-6}	Expansion ratio
245-248	19	251	30.2	29.2	29.3	0.70	0.71	1.38
249-252	21	324	33.7	32.7	32.8	0.70	0.70	1.39
253-256	46	425	47.6	46.0	46.1	1.11	1.01	2.14
257-263	52-53*	425	33.4	32.2	32.3	1.09	0.71	2.09
264-270	58-59*	424	38.9	37.7	37.8	0.70	0.70	1.38
271-277	61-62*	429	28.4	27.6	27.7	0.68	0.50	1.36
278-284	64-65*	422	55.8	54.2	54.4	0.70	1.01	1.39
285-288	67	429	23.9	23.0	23.1	1.10	0.50	2.14
289-292	71	425	13.7	13.2	13.2	1.12	0.29	2.17
293-299	73-75*	425	15.1	14.6	14.7	0.70	0.27	1.39
300-303	77	512	43.9	42.7	42.8	0.70	0.70	1.38
304-307	84	424	73.3	70.8	70.9	1.11	1.56	2.14
308-314	88-89*	424	81.1	78.7	78.9	0.70	1.46	1.38
315-321	91-92*	422	60.4	59.7	59.8	0.39	0.70	1.11

*Dual run numbers indicate combined aero and heat transfer runs with heat transfer data recorded under first number and aero recorded under second number.



*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	1.24000E 02
B	1.22000E 02
C	1.20000E 02
D	1.18000E 02
E	1.16000E 02
F	1.14000E 02
G	1.12000E 02
H	1.10000E 02
MAX	1.24237E 02
MIN	1.09764E 02

RUN 19 MACH=.7 TGAS=250. RE=.7E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 12:22:07 79/337

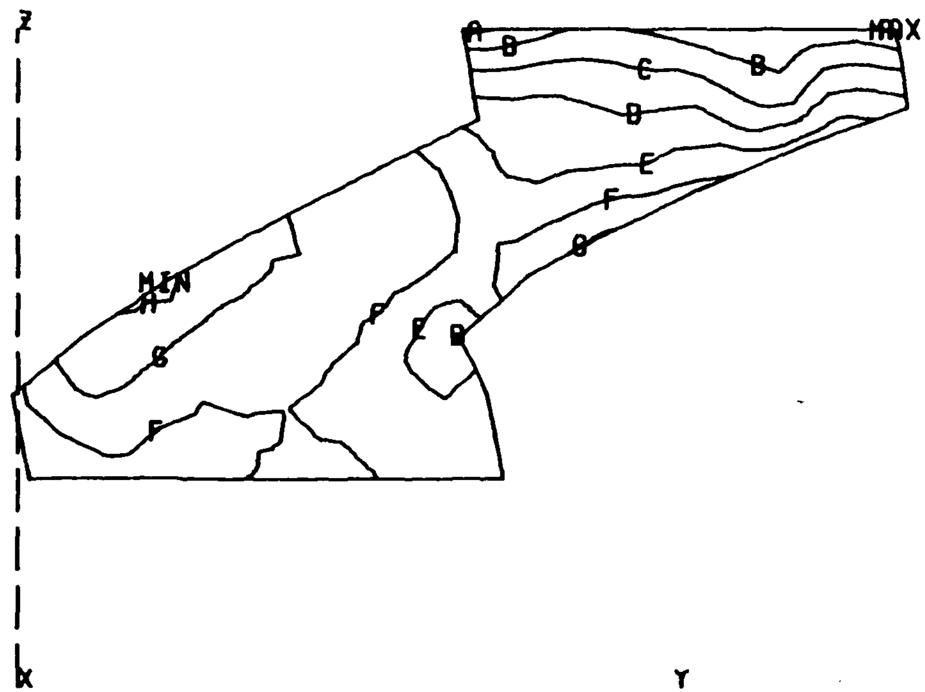


*** LEGEND ***	F (E-06)
A	-2200.00
B	-2900.00
C	-3600.00
D	-4300.00
E	-5000.00
F	-5699.99
G	-6399.99
MAX	-2212.25
MIN	-7060.48

RUN 19 MACH=.7 TGAS=250. RE=.7E06 ANNULAR HUB

CONTOUR PLOT OF STANTON NUMBER.

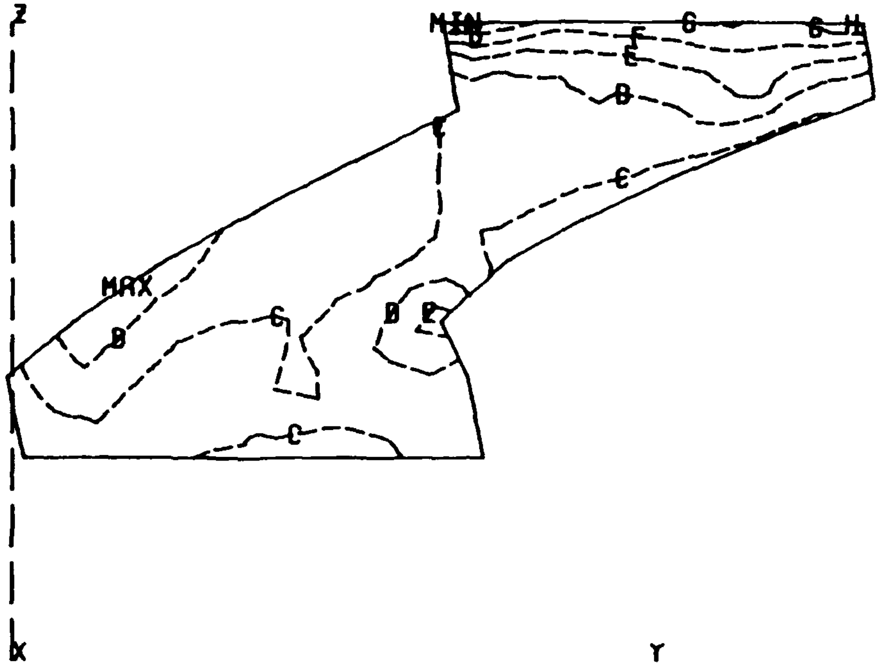
SCALE = 2.0000 PLOT TIME AND DATE = 12:23:07 79/337



*** LEGEND ***

	F
A	169.00
B	164.00
C	159.00
D	154.00
E	149.00
F	144.00
G	139.00
H	134.00
MAX	169.75
MIN	133.14

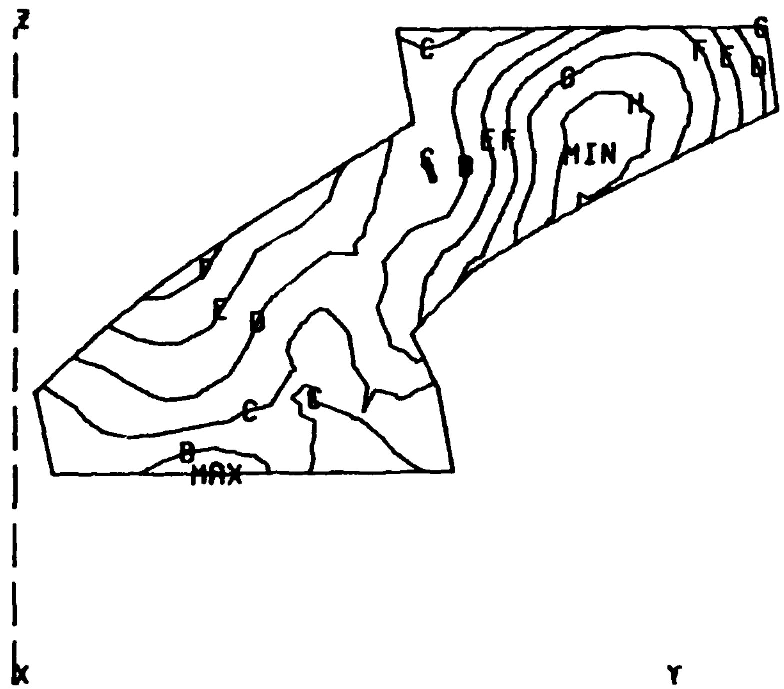
RUN 19 MACH=.7 TGAS=250. RE=.7E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 16:43:14 80/021



*** LEGEND ***

	F (E-03)
A	-2.00
B	-4.00
C	-6.00
D	-8.00
E	-10.00
F	-12.00
G	-14.00
H	-16.00
MAX	-2.86
MIN	-16.62

RUN 19 MACH=.7 TGAS=250. RE=.7E06 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 16:46:59 80/021

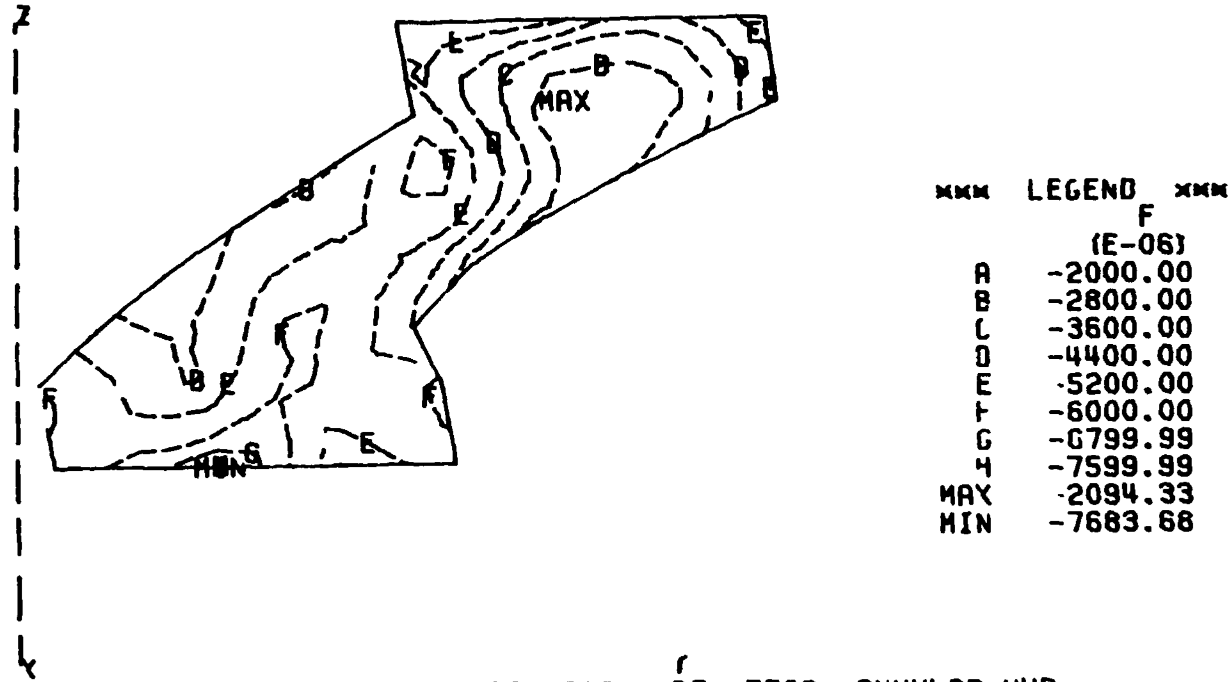


*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	1.56000E 02
B	1.53000E 02
C	1.50000E 02
D	1.47000E 02
E	1.44000E 02
F	1.41000E 02
G	1.38000E 02
H	1.35000E 02
MAX	1.56131E 02
MIN	1.33402E 02

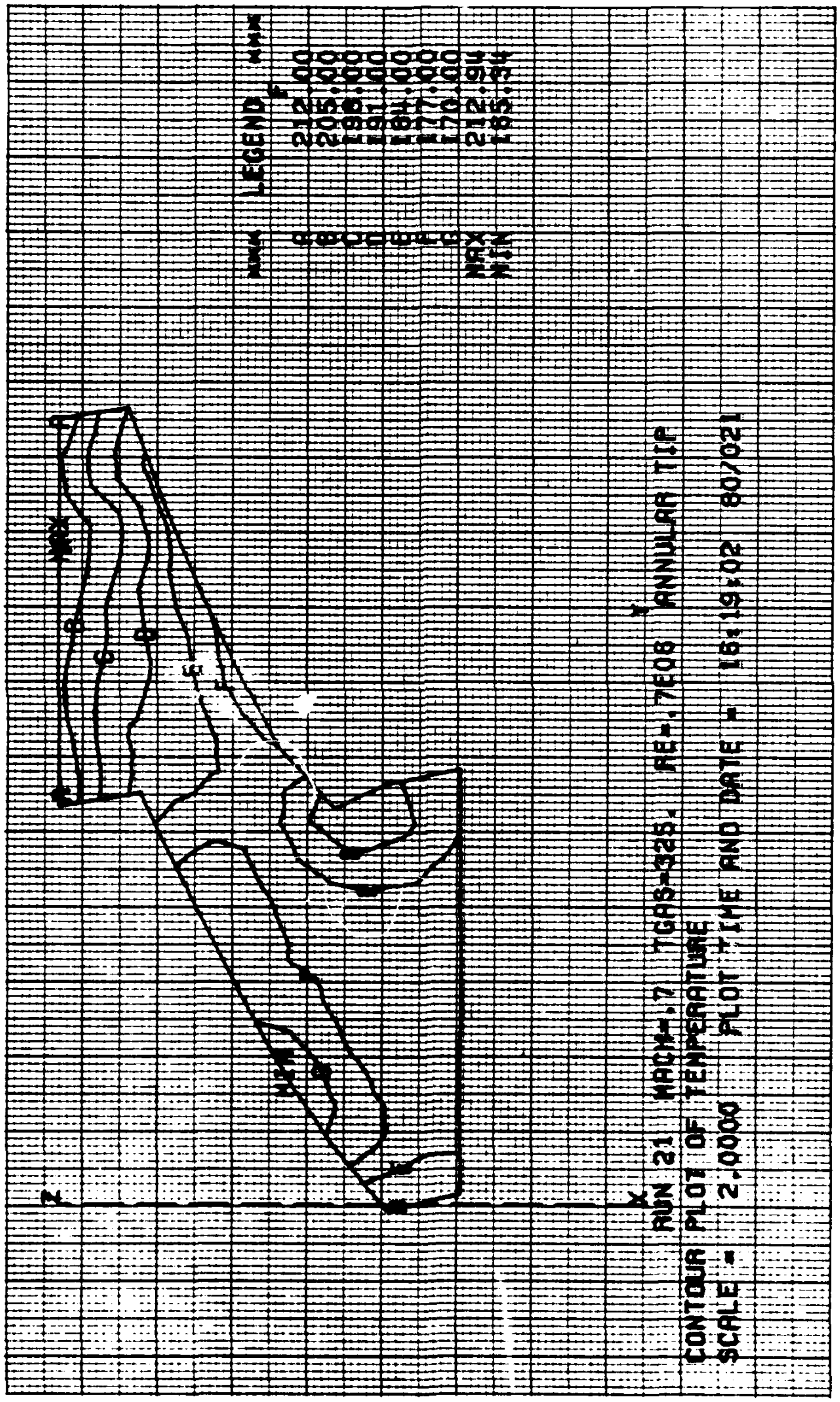
RUN 21 MACH=.7 TGAS=250. RE=.7E06 ANNULAR HUB

CONTOUR PLOT OF TEMPERATURE

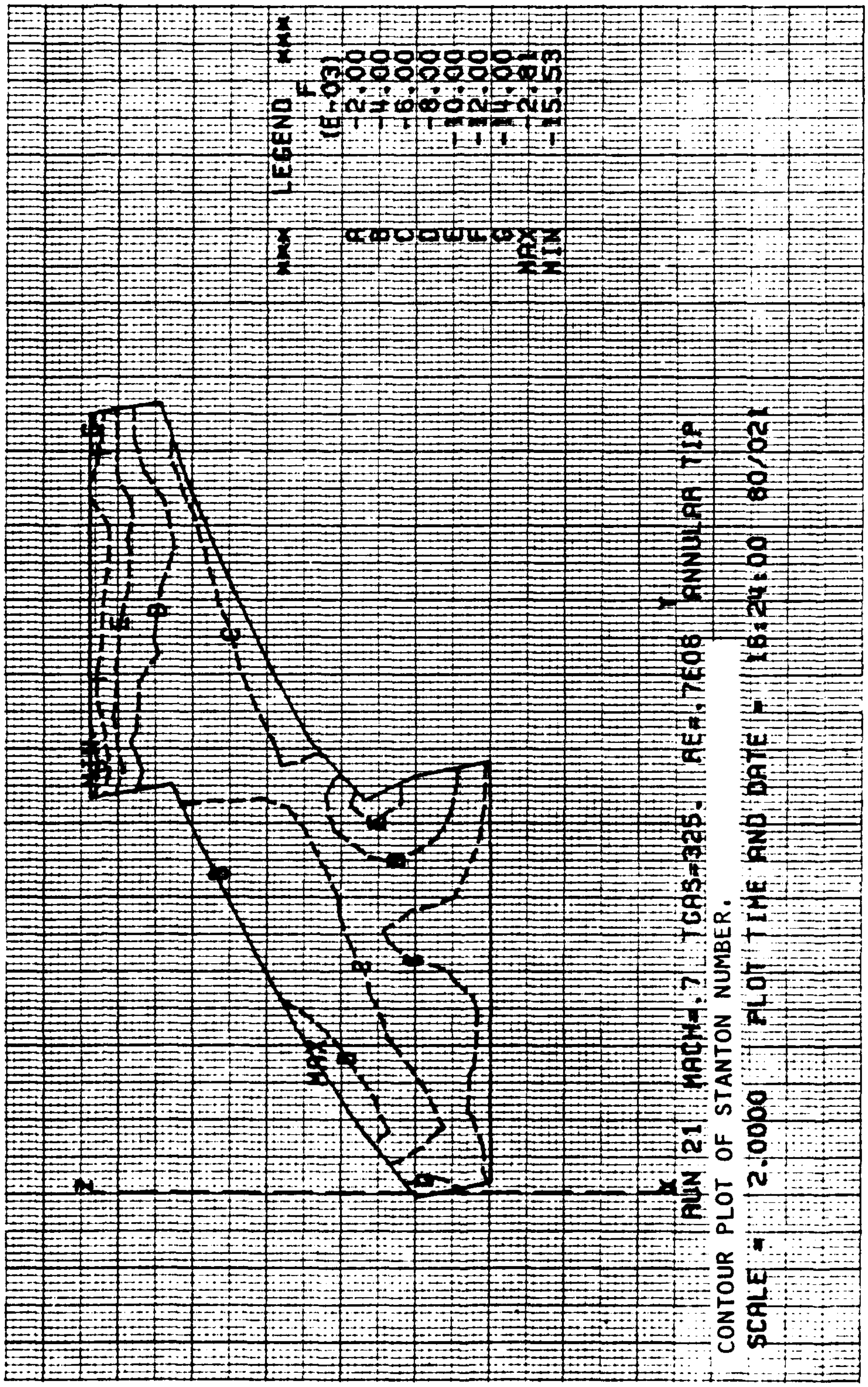
SCALE = 2.0000 PLOT TIME AND DATE = 12:58:59 79/337



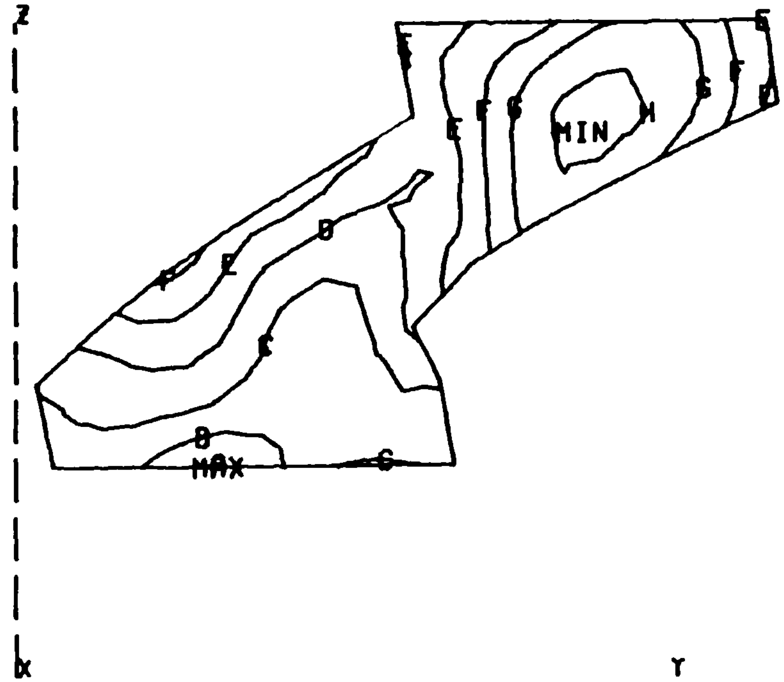
RUN 21 MACH=.7 TGAS-250. RE-.7E06 ANNULAR HUB
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 17:02:34 60/008



LEGEND
F
A 212.00
B 205.00
C 198.00
D 191.00
E 184.00
F 177.00
G 170.00
MAX 212.94
MIN 185.34
MAX
MIN
Z
X
Y
RUN 21 MACH=.7 TGAS=325. RE=.7E08 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 16:19:02 80/021



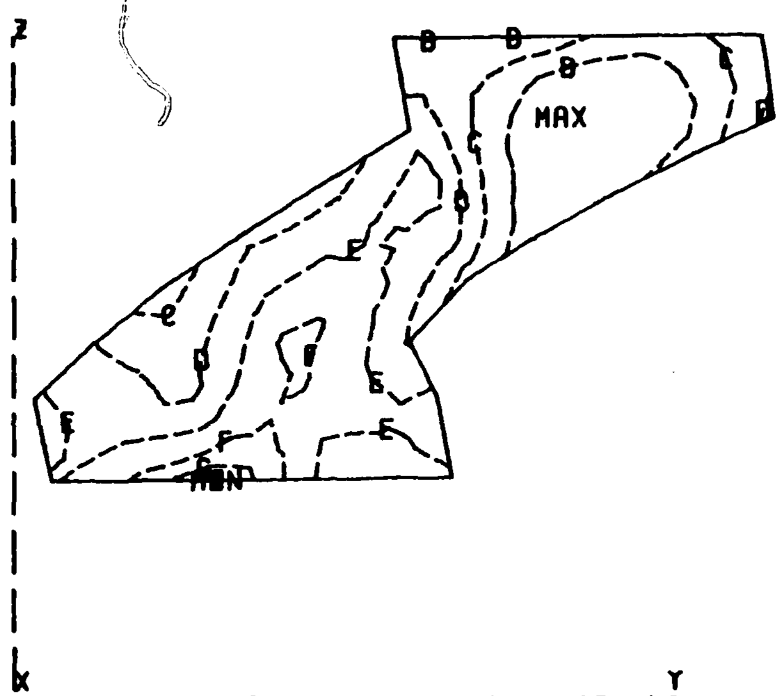
*** LEGEND ***
F
(E-03)
A -2.00
B -4.00
C -6.00
D -8.00
E -10.00
F -12.00
G -14.00
MAX -2.81
MIN -15.53
RUN 21 MACH=.7 TGAS=325. RE=.7E06 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 16:24:00 80/021



*** LEGEND ***
UNITS = TEMP

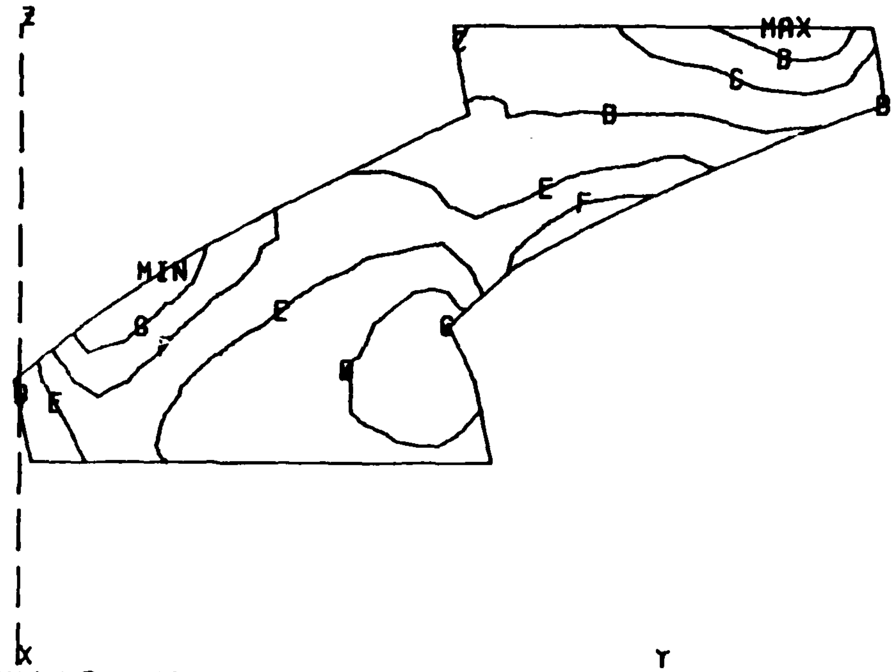
SYMBOL	CONTOUR
A	2.31000E 02
B	2.24000E 02
C	2.17000E 02
D	2.10000E 02
E	2.03000E 02
F	1.96000E 02
G	1.89000E 02
H	1.82000E 02
MAX	2.31681E 02
MIN	1.80053E 02

RUN 46 MACH 1.1 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:31:18 79/324



***	LEGEND	***
	F (E-06)	
A	-1600.00	
B	-2600.00	
C	-3600.00	
D	-4600.00	
E	-5600.00	
F	-6600.00	
G	-7599.99	
H	-8599.99	
MAX	-1652.89	
MIN	-8632.46	

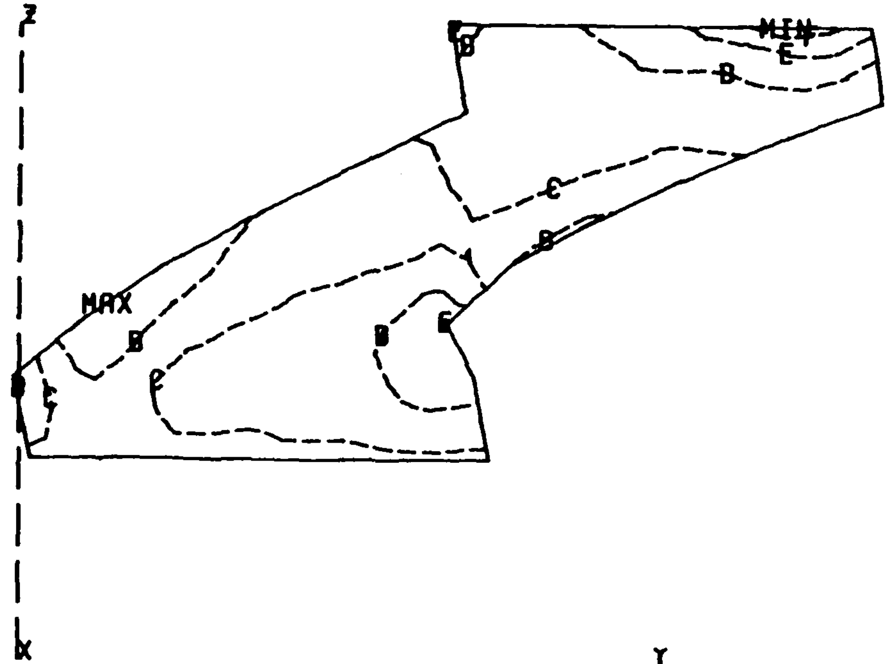
RUN 46 MACH 1.1 ANNULAR HUB
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 18:13:04 80/010



*** LEGEND ***

	F
A	294.00
B	284.00
C	274.00
D	264.00
E	254.00
F	244.00
G	234.00
MAX	294.30
MIN	226.88

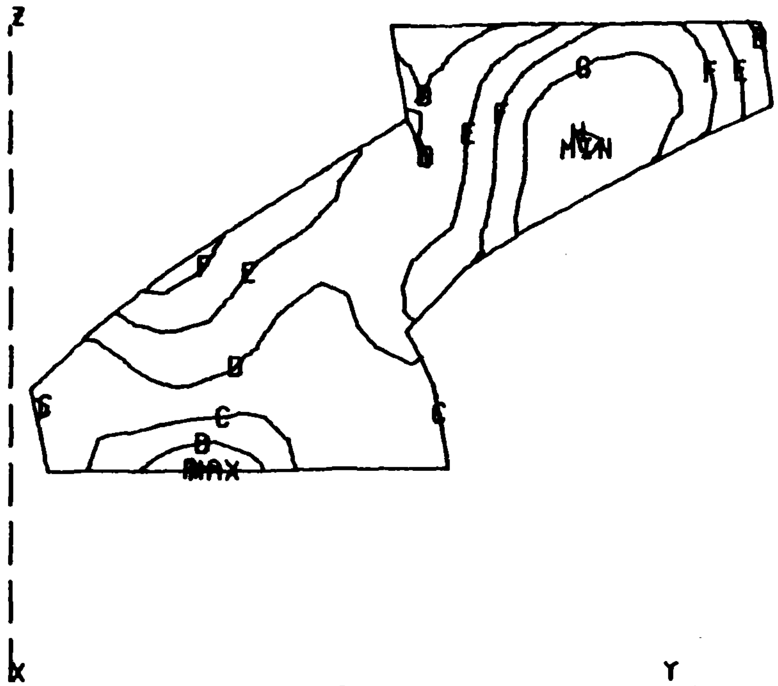
RUN 46 MACH 1.1 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 7:46:20 80/017



*** LEGEND ***

	F (E-03)
A	-2.00
B	-4.00
C	-6.00
D	-8.00
E	-10.00
F	-12.00
MAX	-2.24
MIN	-13.33

RUN 46 MACH 1.1 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 7:46:31 80/017

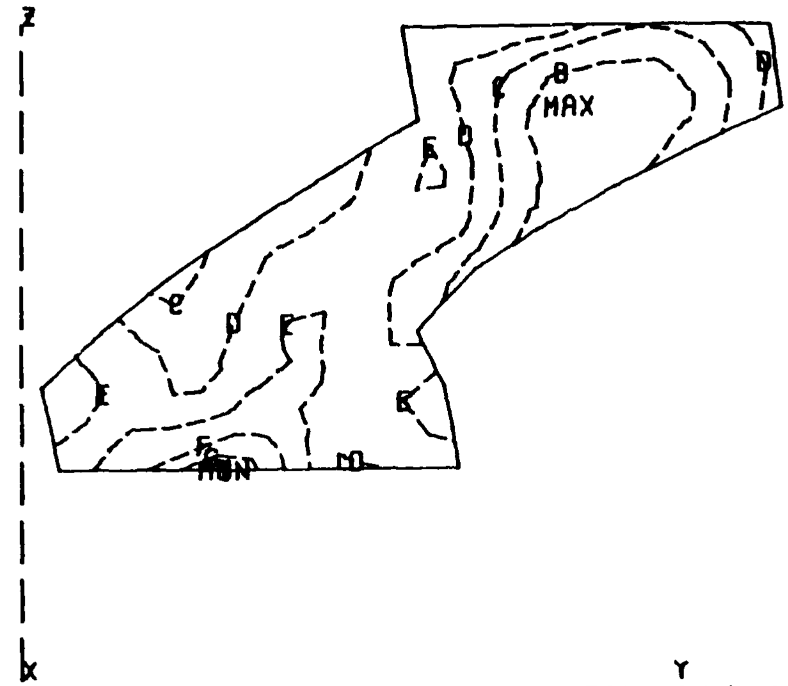


*** LEGEND ***

UNITS = TEMP

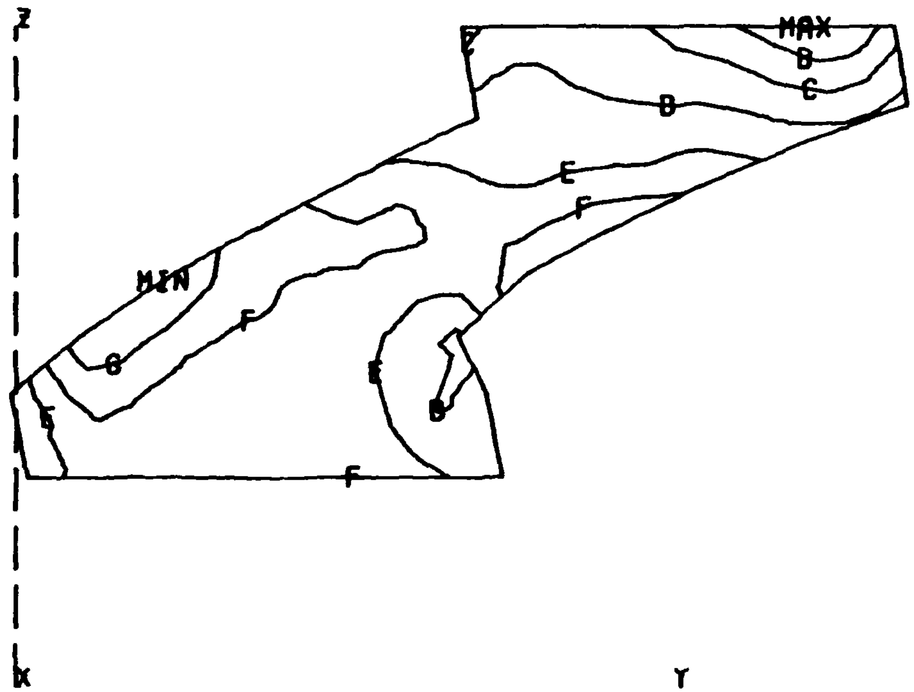
SYMBOL	CONTOUR
A	1.96000E 02
B	1.91000E 02
C	1.86000E 02
D	1.81000E 02
E	1.76000E 02
F	1.71000E 02
G	1.66000E 02
H	1.61000E 02
MAX	1.96670E 02
MIN	1.60839E 02

RUN 52 MACH 1.1 RE .7E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 12:41:42 79/334



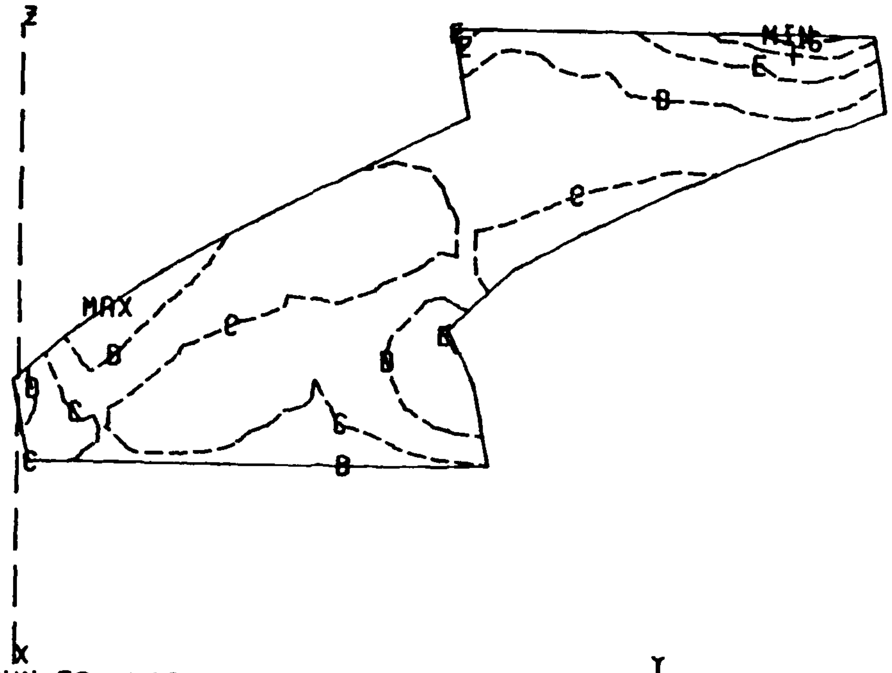
*** LEGEND ***	F (E-06)
A	-2000.00
B	-2900.00
C	-3800.00
D	-4700.00
E	-5600.00
F	-6499.99
G	-7399.99
H	-8299.99
MAX	-2083.14
MIN	-8410.64

RUN 52 MACH 1.1 RE .7E06 ANNULAR HUB
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 18:17:44 80/014



***	LEGEND F ***
A	273.00
B	263.00
C	253.00
D	243.00
E	233.00
F	223.00
G	213.00
MAX	273.92
MIN	205.40

RUN 52 MACH 1.1 RE .7E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:13:13 80/028



*** LEGEND ***	F (E-03)
A	-2.00
B	-4.00
C	-6.00
D	-8.00
E	-10.00
F	-12.00
G	-14.00
MAX	-2.62
MIN	-15.30

RUN 52 MACH 1.1 RE .7E06 ANNULAR TIP

CONTOUR PLOT OF STANTON NUMBER,
SCALE = 2.0000 PLOT TIME AND DATE = 17:13:42 80/028

11-20-79 VANE SURVEY W/HT SURVEY

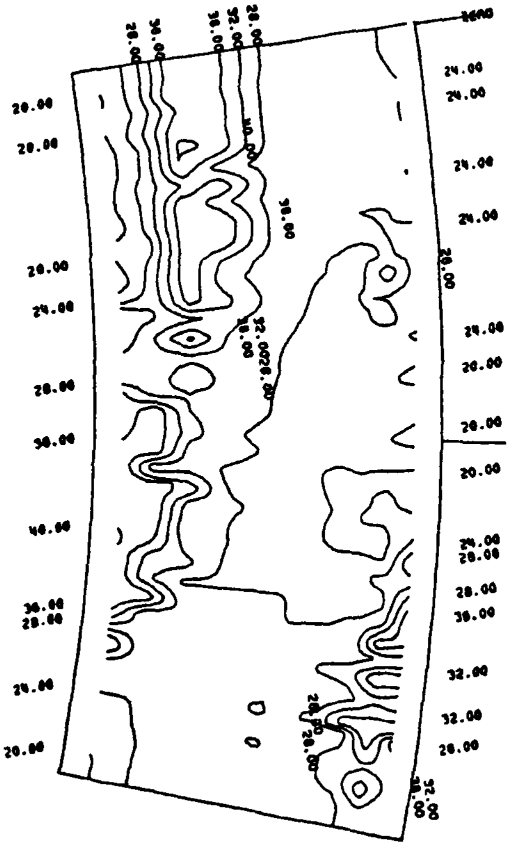
TIME 10:20 RDG 53 RIG 1 BU 51

COMPLETE PASSAGE DATA

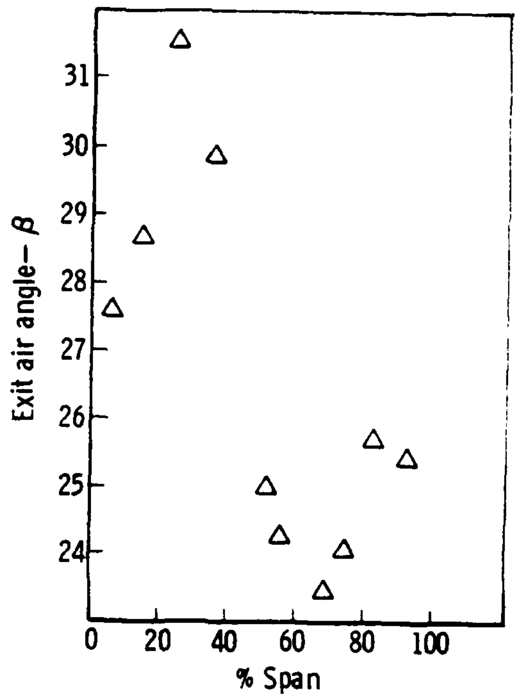
**** KE COEF	OMEGA ID	OMEGA ACT	DELTA P/P	**** FLOW RATE
0.09033	0.12789	0.17995	0.0677	4.440

RADIUS INCHES	O/O SPAN	KE COEF	OMEGA ID MASS AVG	OMEGA ACT MASS AVG	DELTA P/P MASS AVG	FLOW/L LB/SEC IN
4.5400	91.852	0.14254	0.19776	0.25758	0.09448	5.38093
4.4900	84.444	0.07226	0.10466	0.12028	0.05096	6.24744
4.4400	77.037	0.04797	0.07048	0.07913	0.03482	7.62084
4.3900	69.630	0.03695	0.05500	0.06088	0.02761	7.51053
4.3100	57.778	0.03401	0.05155	0.05613	0.02651	6.57683
4.2800	53.333	0.03355	0.05116	0.05567	0.02656	6.44471
4.1700	37.037	0.02869	0.04459	0.04883	0.02392	6.36375
4.1000	26.667	0.04902	0.07696	0.08501	0.04213	6.53933
4.0300	16.296	0.15593	0.23194	0.31745	0.12941	6.88042
3.9700	7.407	0.24630	0.34661	0.61615	0.19675	6.52975

KE COEF MIXED	OMEGA ID MIXED	OMEGA ACT MIXED	DELTA P/P MIXED	GAS ANGLE MIXED	KE MIX/KE
0.15756	0.21801	0.27879	0.10284	25.5343	1.10534
0.08468	0.12212	0.13911	0.05878	25.7567	1.17187
0.05310	0.07854	0.08523	0.03861	24.1206	1.10673
0.03949	0.05937	0.06312	0.02972	23.5742	1.06857
0.03576	0.05464	0.05779	0.02803	24.2727	1.05131
0.03499	0.05379	0.05685	0.02786	24.9708	1.04298
0.04181	0.06477	0.06925	0.03418	29.9198	1.45718
0.06188	0.09600	0.10619	0.05166	31.6230	1.26252
0.16887	0.25123	0.33552	0.13900	28.7319	1.08299
0.27622	0.38953	0.63809	0.21744	27.6099	1.12146



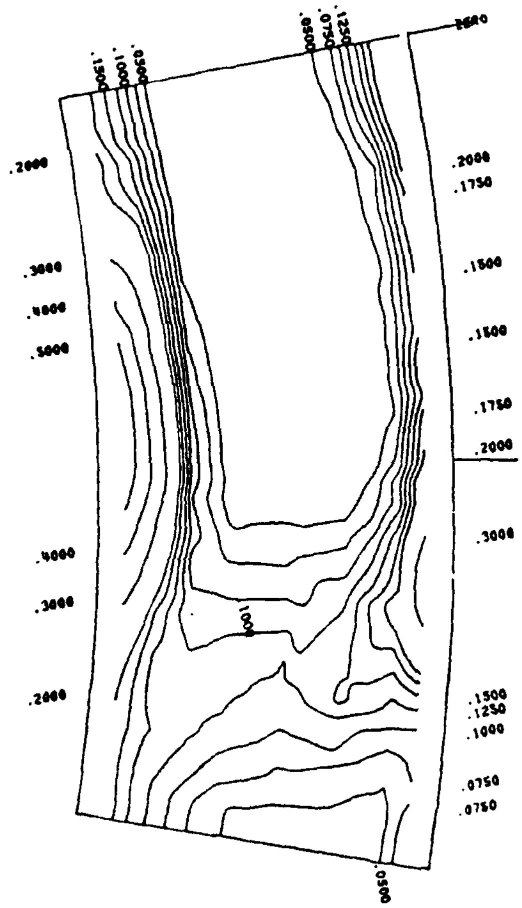
Local β contours



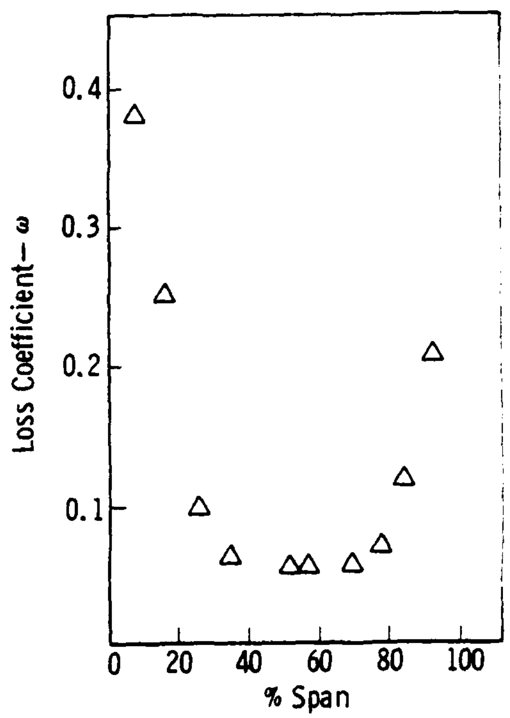
Exit Mach No. = 1.1 Reynolds No. = 0.7×10^6

Reading 53 - aerodynamic exit data

TE-80-996



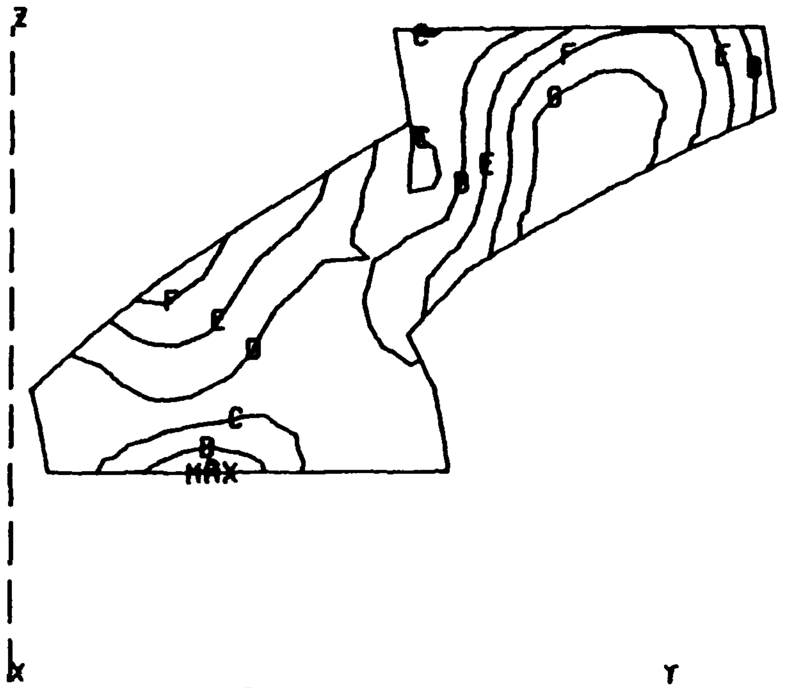
Local ω contours



Exit Mach No. = 1.1 Reynolds No. = 0.7 x 10^6

Reading 53 - aerodynamic exit data

TE-80-997



*** LEGEND ***

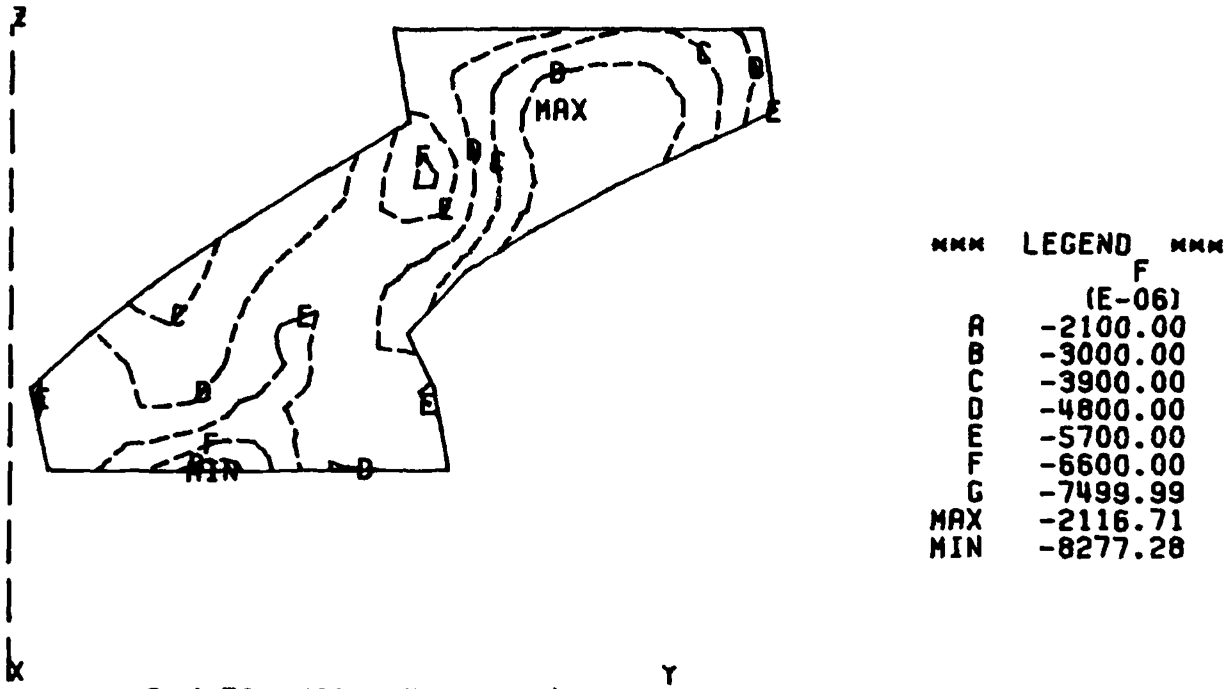
UNITS = TEMP

SYMBOL	CONTOUR
A	2.02000E 02
B	1.97000E 02
C	1.92000E 02
D	1.87000E 02
E	1.82000E 02
F	1.77000E 02
G	1.72000E 02
MAX	2.02639E 02
MIN	1.67281E 02

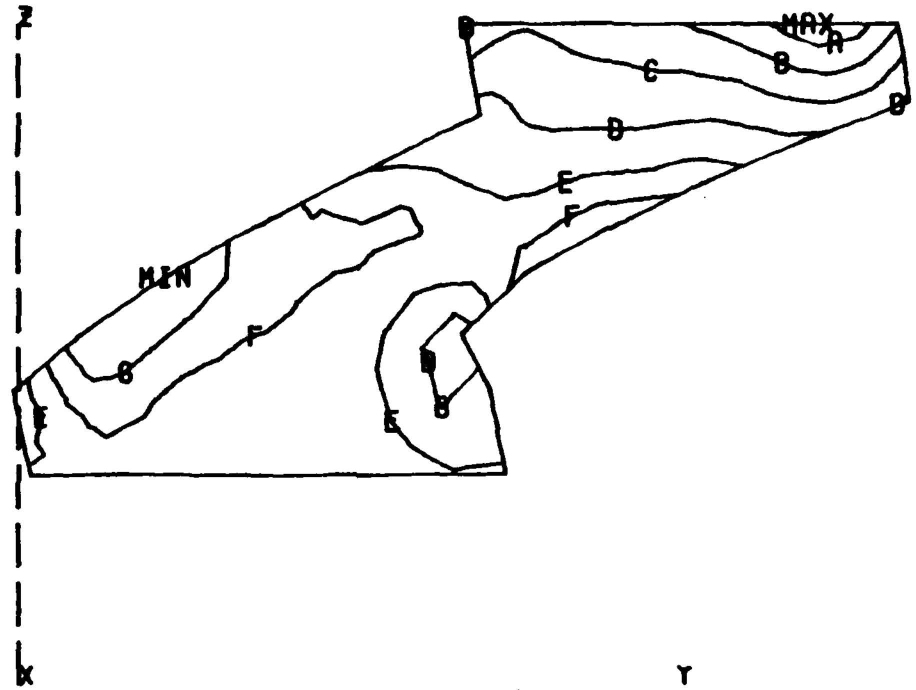
RUN 58 MACH .7 RE .7E06 ANNULAR HUB

CONTOUR PLOT OF TEMPERATURE

SCALE = 2.0000 PLOT TIME AND DATE = 12:05:23 79/338

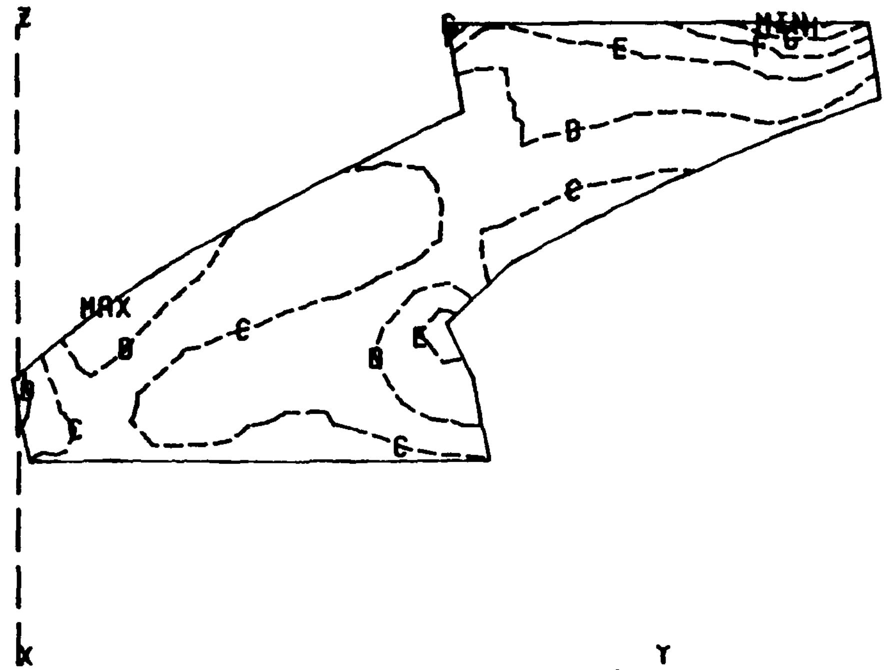


RUN 58 MACH .7 RE .7E06 ANNULAR HUB
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 18:28:37 80/014



*** LEGEND ***	F
A	280.00
B	270.00
C	260.00
D	250.00
E	240.00
F	230.00
G	220.00
MAX	287.21
MIN	210.76

RUN 58 MACH .7 RE .7E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:44:49 80/028



*** LEGEND ***	F (E-03)
A	-2.00
B	-4.00
C	-6.00
D	-8.00
E	-10.00
F	-12.00
G	-14.00
H	-16.00
MAX	-2.49
MIN	-16.88

RUN 58 MACH .7 RE .7E06 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 17:45:10 80/028

11-20-79 VANE SURVEY W/HT SURVEY

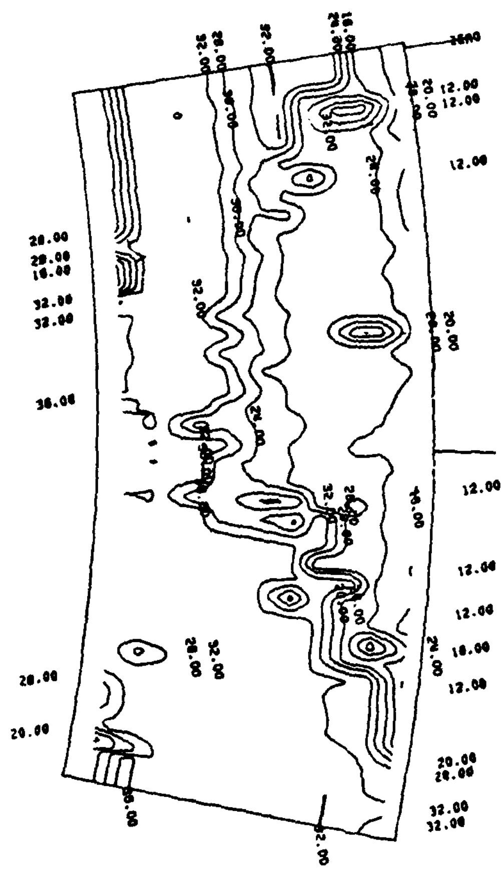
TIME 13:37 RDG 59 RIG 1 BU 51

**** COMPLETE PASSAGE DATA ****

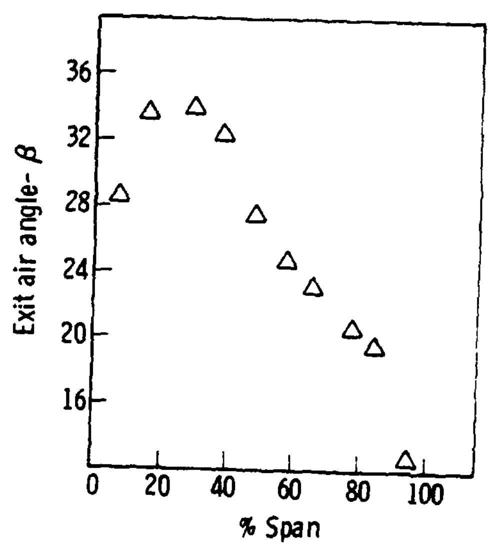
KE COEF	OMEGA ID	OMEGA ACT	DELTA P/P	FLOW RATE
0.08076	0.09316	0.12020	0.0262	4.613

RADIUS INCHES	O/O SPAN	KE COEF	OMEGA ID MASS AVG	OMEGA ACT MASS AVG	DELTA P/P MASS AVG	FLOW/L LB/SEC IN
4.5600	94.815	0.18097	0.20849	0.26549	0.05077	6.51383
4.4900	84.444	0.07324	0.08643	0.09565	0.02167	8.40333
4.4400	77.037	0.04657	0.05551	0.06001	0.01413	9.09713
4.3700	66.667	0.03330	0.03991	0.04247	0.01041	8.79849
4.3200	59.259	0.02777	0.03344	0.03530	0.00893	7.52171
4.2500	49.889	0.02525	0.03061	0.03204	0.00832	7.03134
4.1700	37.037	0.01654	0.02016	0.02114	0.00563	6.51747
4.1200	29.630	0.03297	0.04030	0.04259	0.01150	5.80755
4.0300	16.296	0.12548	0.15068	0.19521	0.04431	5.57561
3.9700	7.407	0.22679	0.26629	0.39560	0.07984	3.51175

KE COEF MIXED	OMEGA ID MIXED	OMEGA ACT MIXED	DELTA P/P MIXED	GAS ANGLE MIXED	KE MIX/K
0.18418	0.21217	0.26932	0.05152	13.1021	[illegible]
0.08737	0.10278	0.11455	0.02540	19.9414	[illegible]
0.06231	0.07334	0.07973	0.01850	20.9319	[illegible]
0.05097	0.06077	0.06470	0.01554	23.3523	[illegible]
0.04285	0.05138	0.05416	0.01340	25.3459	[illegible]
0.03330	0.04029	0.04198	0.01086	27.2333	[illegible]
0.02046	0.02499	0.02564	0.00694	32.5344	[illegible]
0.03521	0.04310	0.04504	0.01225	34.3355	[illegible]
0.12754	0.15399	0.18202	0.04519	34.0925	[illegible]
0.24825	0.29159	0.41160	0.09555	29.7498	[illegible]



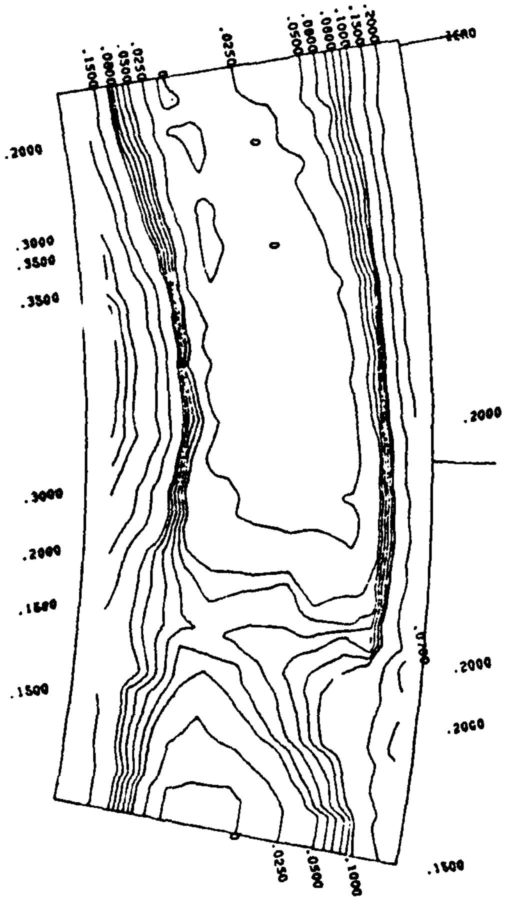
Local β contours



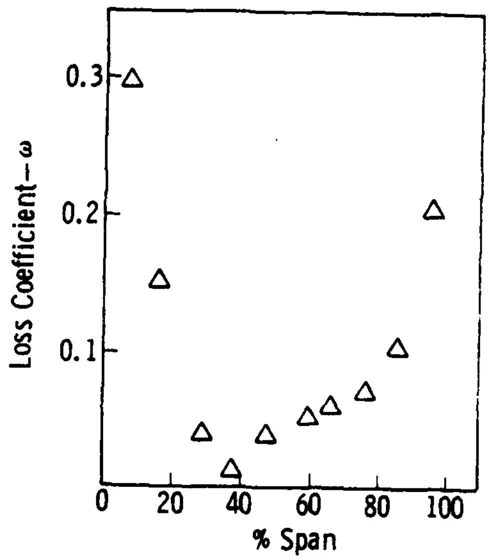
TE-80-998

Exit Mach No. = 0.7 Reynolds No. = 0.7 x 10^6

Reading 59 - aerodynamic exit data

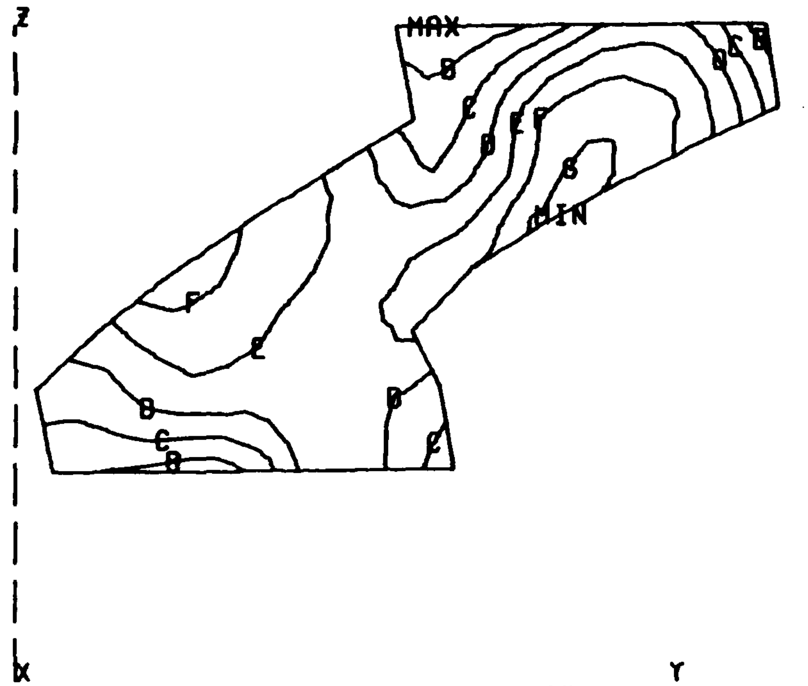


Local ω contours



Exit Mach No. = 0.7 Reynolds No. = 0.7 x 10^6
Reading 59 - aerodynamic exit data

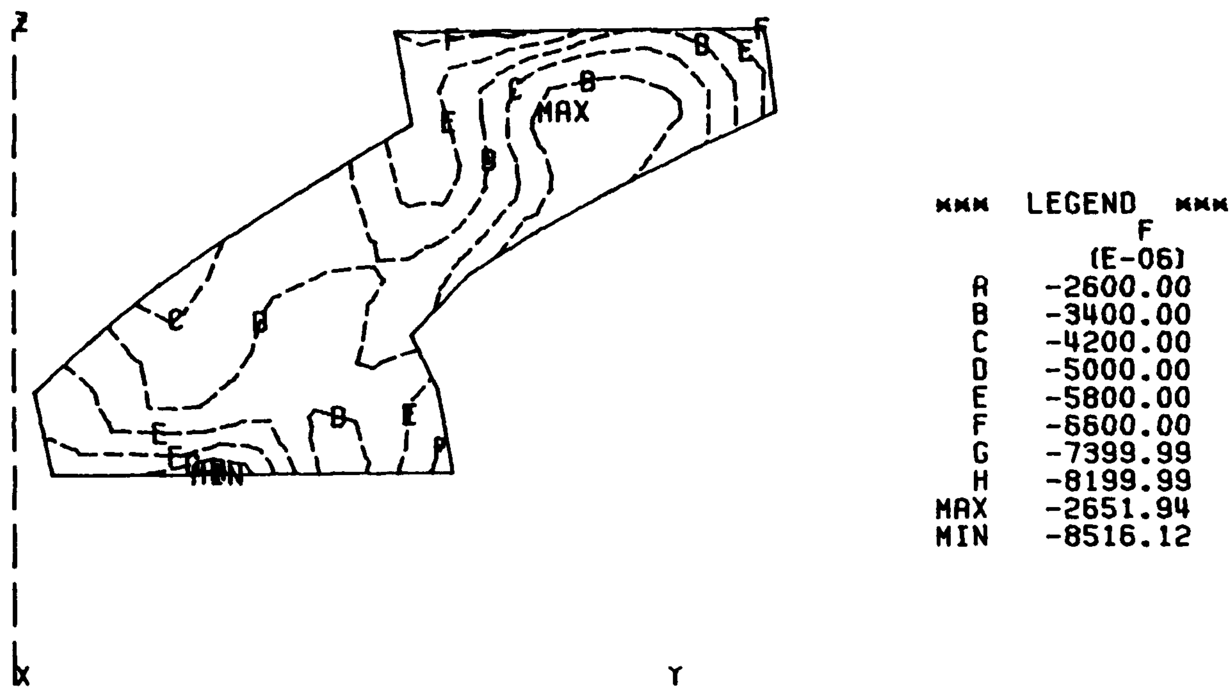
TE-80-999



*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	1.81000E 02
B	1.77000E 02
C	1.73000E 02
D	1.69000E 02
E	1.65000E 02
F	1.61000E 02
G	1.57000E 02
MAX	1.81015E 02
MIN	1.54915E 02

RUN 61 MACH .7 RE .5E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 13:43:56 79/338

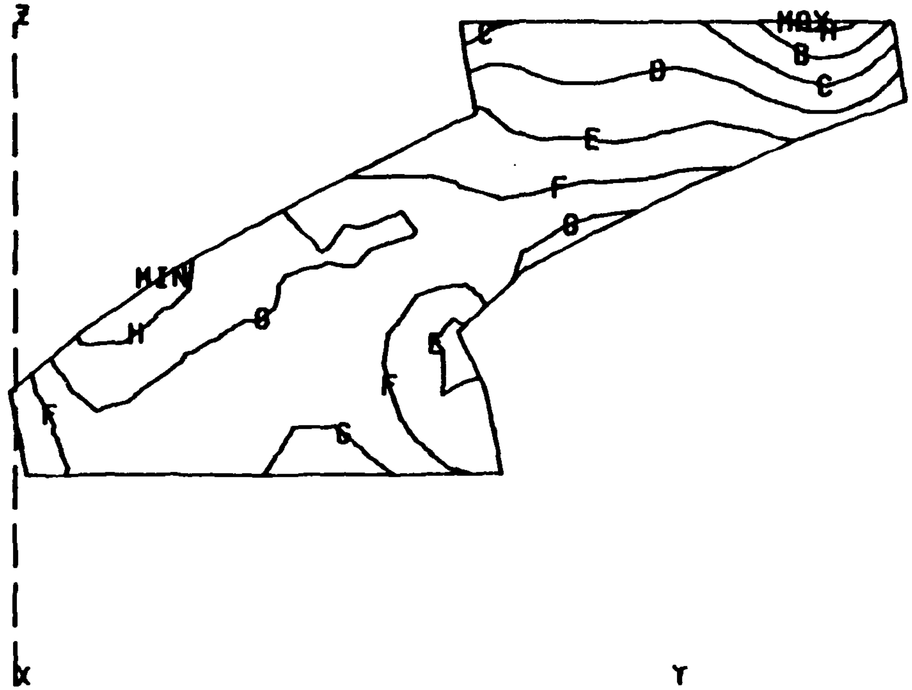
PRECEDING PAGE BLANK-NOT FILMED



RUN 61 MACH .7 RE .5E06 ANNULAR HUB

CONTOUR PLOT OF STANTON NUMBER.

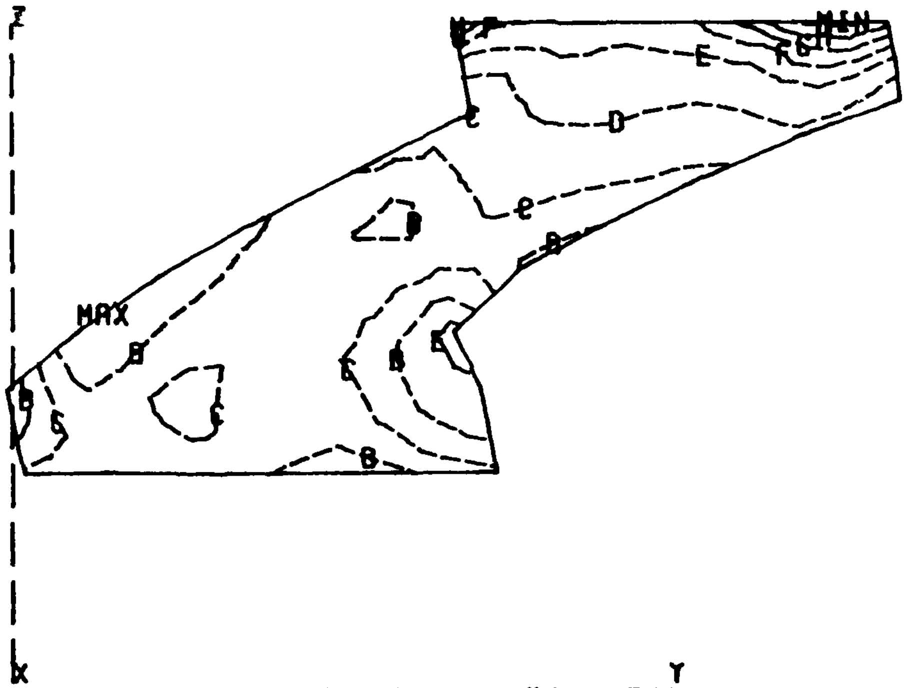
SCALE = 2.0000 PLOT TIME AND DATE = 17:57:04 80/015



RUN 61 MACH .7 RE .5E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE =   2.0000   PLOT TIME AND DATE = 18:03:29 80/030

*** LEGEND ***

	F
A	270.00
B	260.00
C	250.00
D	240.00
E	230.00
F	220.00
G	210.00
H	200.00
MAX	272.83
MIN	196.41



*** LEGEND ***

	F (E-03)
A	-3.00
B	-5.00
C	-7.00
D	-9.00
E	-11.00
F	-13.00
G	-15.00
H	-17.00
I	-19.00
MAX	-3.04
MIN	-19.93

RUN 61 MACH .7 RE .5E06 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 18:04:03 80/030

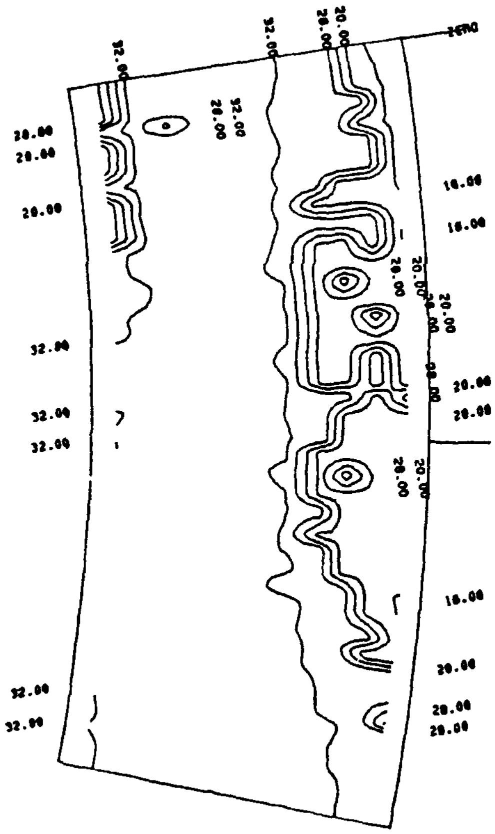
11-26-79 VANE SURVEY W/HT SURVEY

TIME 9:22 RDG 62 RIG 1 80 51

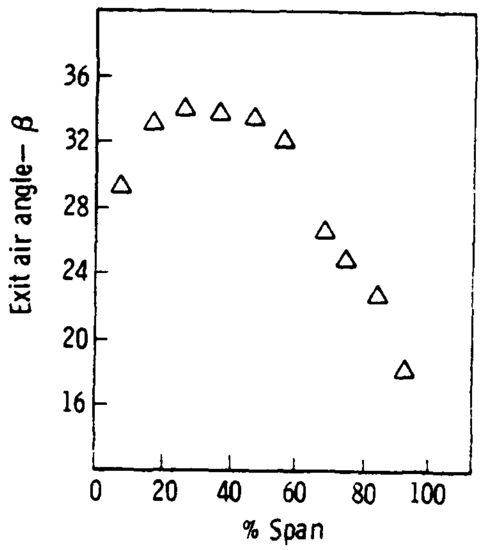
****		COMPLETE PASSAGE DATA		****
KE COEF	OMEGA ID	OMEGA ACT	DELTA P/P	FLOW RATE
0.07536	0.08549	0.11207	0.0231	3.689

RADIUS INCHES	O/T SPAN	KE COEF	OMEGA ID MASS AVG	OMEGA ACT MASS AVG	DELTA P/P MASS AVG	FLOW/L LB/SEC IN
[illegible]	93.333	0.12166	0.15213	0.18030	0.03562	4.76065
[illegible]	84.444	0.06948	0.08141	0.08925	0.01930	5.95199
[illegible]	75.556	0.03380	0.04000	0.04258	0.00993	6.41952
[illegible]	63.148	0.02358	0.02803	0.02950	0.00693	6.61194
[illegible]	57.778	[illegible]	0.01852	0.01955	0.00475	6.54370
[illegible]	47.407	0.01027	0.01239	0.01312	0.00323	6.39423
4.1700	37.037	0.01393	0.01670	0.01760	0.00449	5.38804
[illegible]	26.557	[illegible]	0.06516	0.07151	0.01839	5.09519
[illegible]	17.778	0.12946	0.15403	0.18912	0.04333	4.61441
[illegible]	7.407	0.23979	0.27817	0.42607	0.07979	3.60541

KE COEF MIXED	OMEGA ID MIXED	OMEGA ACT MIXED	DELTA P/P MIXED	GAS ANGLE MIXED	KE MIX/KE
0.14297	0.16464	0.19708	0.03817	18.4940	1.08549
0.08399	0.09789	0.10851	0.02385	23.2381	1.20748
0.04699	0.05545	0.05870	0.01338	25.3073	1.39034
0.03456	0.04098	0.04273	0.01004	26.8983	1.46534
0.01590	0.01896	0.01933	0.00484	32.1231	1.01376
0.01065	0.01287	0.01304	0.00338	33.1916	1.03783
0.01399	0.01698	0.01728	0.00457	33.9805	1.01128
0.05595	0.06662	0.07137	0.01836	34.1495	1.01332
0.13047	0.15596	0.18478	0.04381	33.5522	1.00782
0.25573	0.29781	0.42611	0.08407	29.4712	1.06645

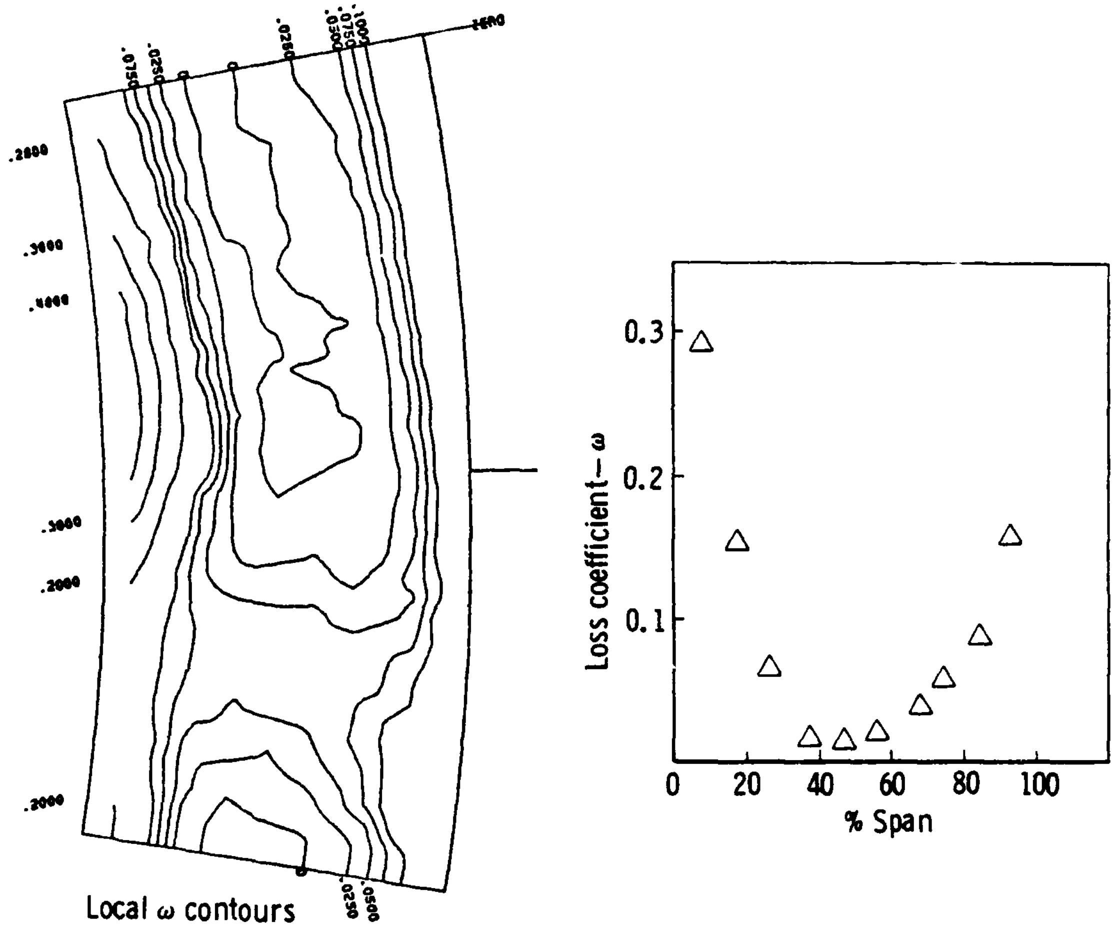


Local β contours



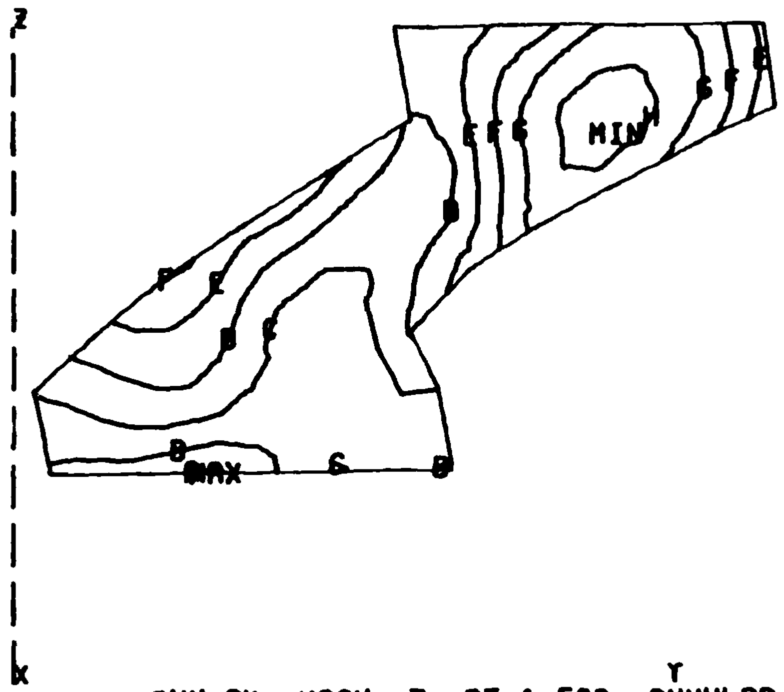
Exit Mach No. = 0.7 Reynolds No. = 0.5×10^6
Reading 62 - aerodynamic exit data

TE-80-1000



Exit Mach No. = 0.7 Reynolds No. = 0.5 x 10^6

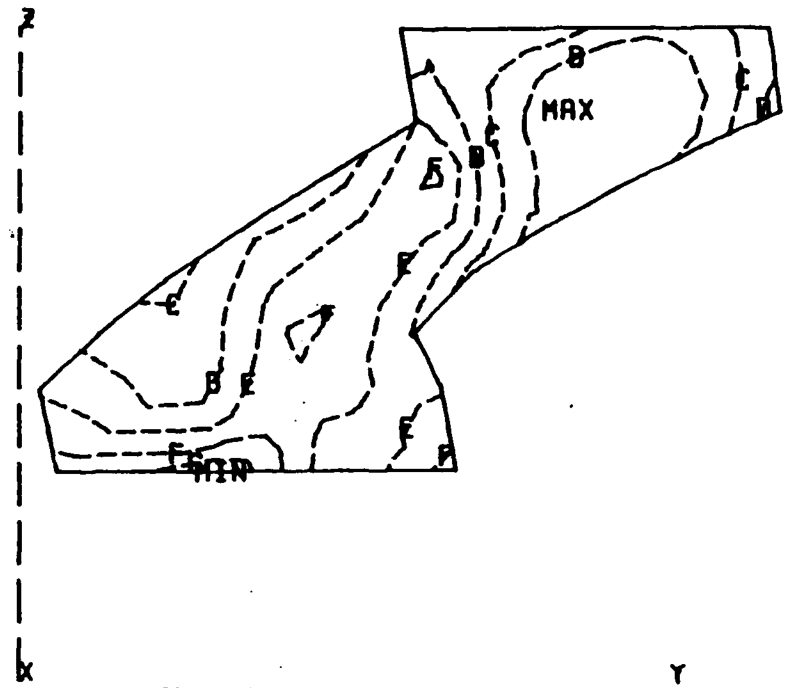
Reading 62 - aerodynamic exit data TE-80-1001



*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	2.36000E 02
B	2.29000E 02
C	2.22000E 02
D	2.15000E 02
E	2.08000E 02
F	2.01000E 02
G	1.94000E 02
H	1.87000E 02
MAX	2.36778E 02
MIN	1.84863E 02

RUN 64 MACH .7 RE 1.E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 16:18:10 79/338



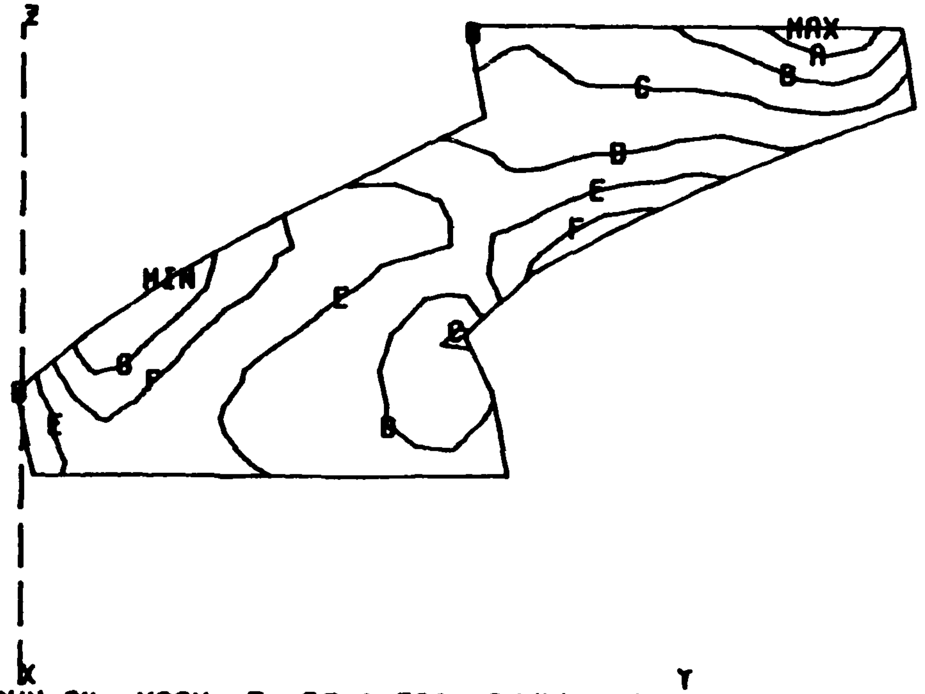
*** LEGEND ***

	F (E-06)
A	-1600.00
B	-2600.00
C	-3600.00
D	-4600.00
E	-5600.00
F	-6600.00
G	-7599.99
MAX	-1636.23
MIN	-8509.50

RUN 64 MACH .7 RE 1.E06 ANNULAR HUB

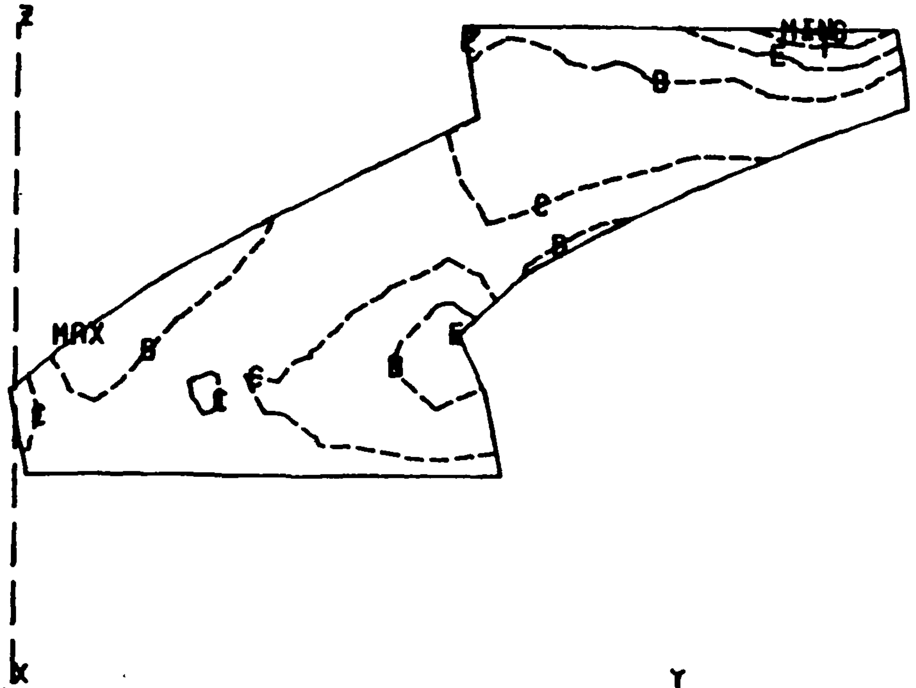
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 18:09:49 80/015



*** LEGEND ***	F
A	300.00
B	290.00
C	280.00
D	270.00
E	260.00
F	250.00
G	240.00
MAX	309.42
MIN	232.43

RUN 64 MACH .7 RE 1.E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 18:18:07 80/030



*** LEGEND ***

	F (E-03)
A	-2.00
B	-4.00
C	-6.00
D	-8.00
E	-10.00
F	-12.00
G	-14.00
MAX	-2.09
MIN	-14.65

RUN 64 MACH .7 RE 1.E06 ANNULAR TIP

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 18:18:36 80/030

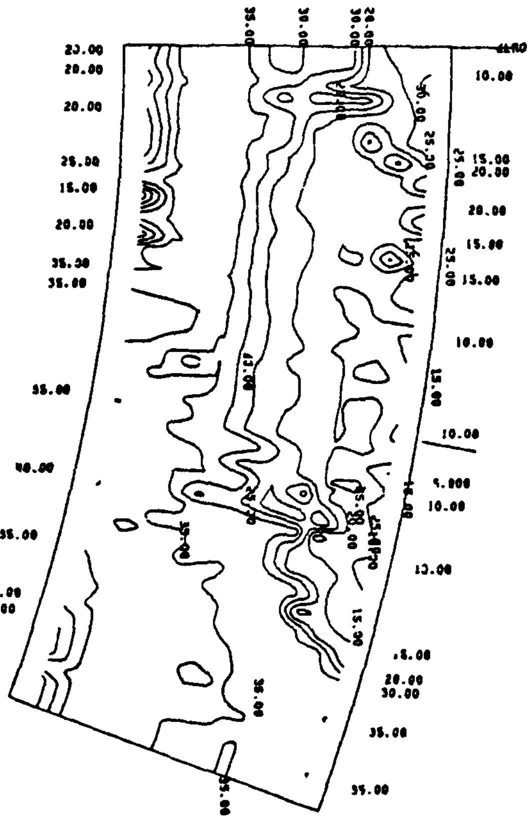
11-26-79 VANE SURVEY W/HT SURVEY

TIME 10:40 RDG 65 RIG 1 BU 51

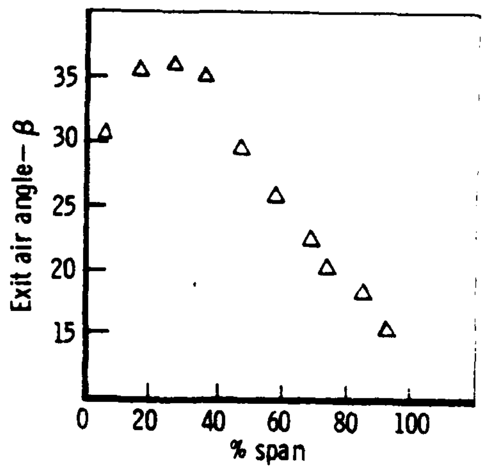
**** KE COEF	OMEGA ID	COMPLETE PASSAGE DATA OMEGA ACT	DELTA P/P	**** FLOW RATE
0.06716	0.07846	0.09859	0.0229	7.008

RADIUS INCHES	O/O SPAN	KE COEF	OMEGA ID MASS AVG	OMEGA ACT MASS AVG	DELTA P/P MASS AVG	FLOW/L LB/SEC IN
4.5500	93.333	0.12789	0.14937	0.17857	0.03749	10.25639
4.4900	84.444	0.06630	0.07854	0.08811	0.02023	13.14618
4.4300	75.556	0.04746	0.05662	0.06250	0.01494	14.01215
4.3900	69.630	0.03575	0.04298	0.04619	0.01153	13.90891
4.3200	59.259	0.02708	0.03286	0.03462	0.00905	11.71078
4.2500	48.889	0.01965	0.02402	0.02507	0.00680	10.28974
4.1700	37.037	0.00547	0.00666	0.00736	0.00193	9.17661
4.1100	28.146	0.02212	0.02733	0.02886	0.00810	8.14738
4.0400	17.776	0.08823	0.10774	0.12536	0.03269	7.59893
3.9700	7.407	0.19727	0.23507	0.33152	0.07306	5.92925

KE COEF MIXED	OMEGA ID MIXED	OMEGA ACT MIXED	DELTA P/P MIXED	GAS ANGLE MIXED	KE MIX/KE
0.16001	0.18534	0.22750	0.04530	15.1706	1.25119
0.08604	0.10167	0.11318	0.02572	18.6776	1.29777
0.07028	0.08362	0.09125	0.02157	20.0236	1.48099
0.05826	0.06967	0.07489	0.01822	22.6162	1.62954
0.04315	0.05212	0.05499	0.01407	25.4702	1.59324
0.02824	0.03450	0.03573	0.00965	29.1776	1.43725
0.00671	0.00831	0.00838	0.00240	35.2536	1.22735
0.02347	0.02909	0.02996	0.00861	36.2799	1.06088
0.08941	0.10973	0.12325	0.03326	35.8477	1.01332
0.21965	0.26135	0.35382	0.07924	30.5656	1.11344

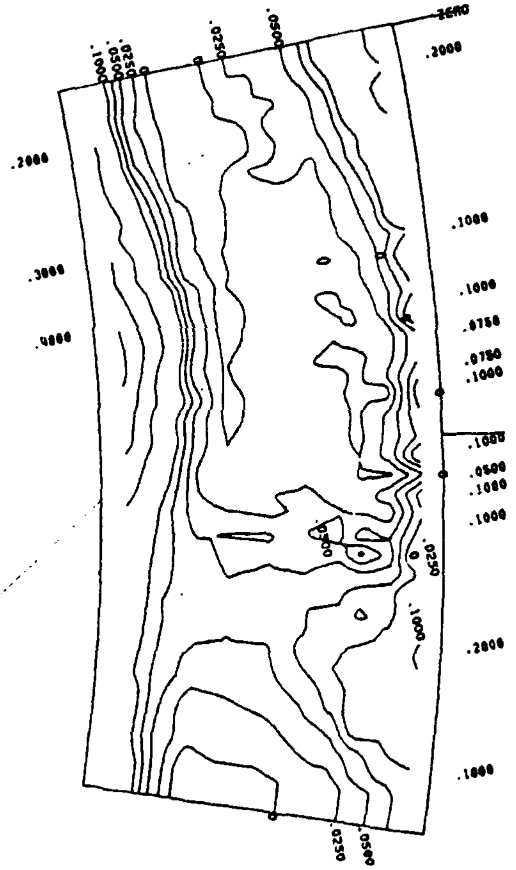


Local β contours

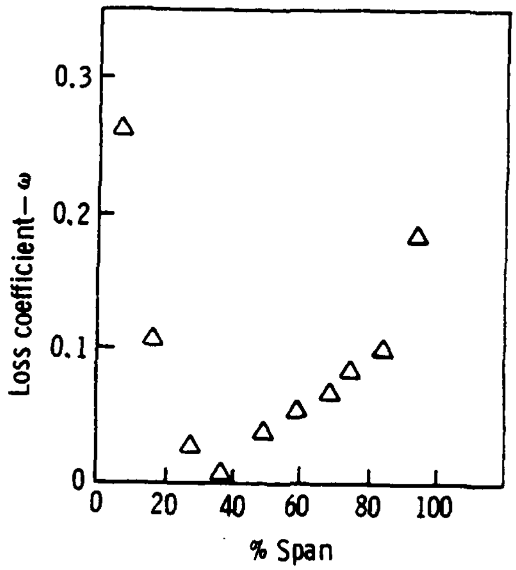


Exit Mach No. - 0.7 Reynolds No. = 1×10^6
Reading 65-aerodynamic exit data

TE-80-1002

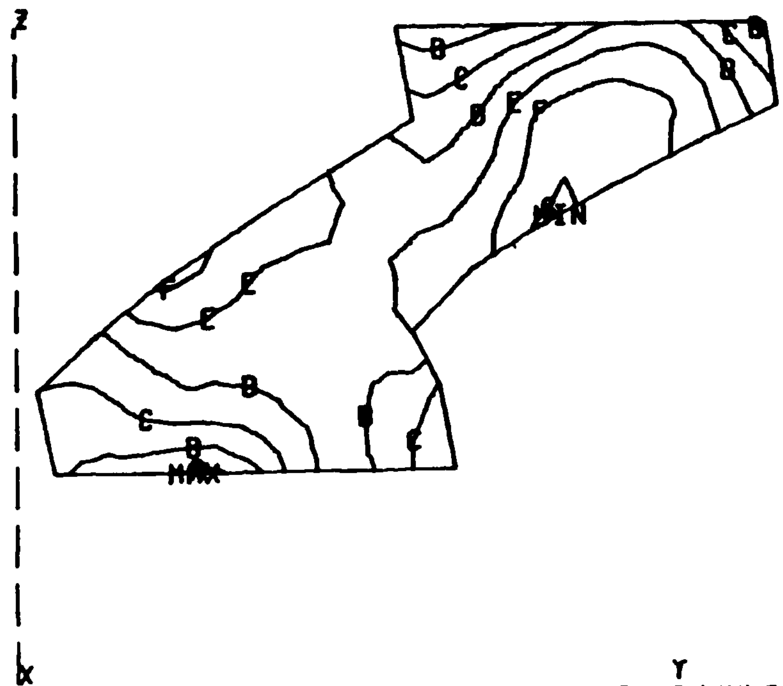


Local ω contours



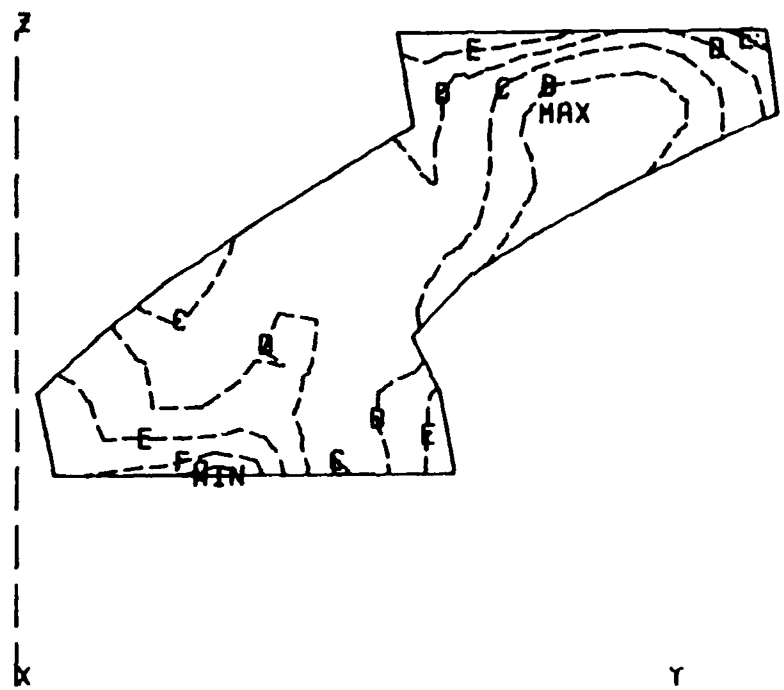
Exit Mach No. - 0.7 Reynolds No. = 1×10^6
Reading 65 - aerodynamic exit data

TE-80-1003



*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	1.73000E 02
B	1.69000E 02
C	1.65000E 02
D	1.61000E 02
E	1.57000E 02
F	1.53000E 02
G	1.49000E 02
MAX	1.73574E 02
MIN	1.48061E 02

RUN 67 MACH 1.1 RE .5E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:51:42 79/338



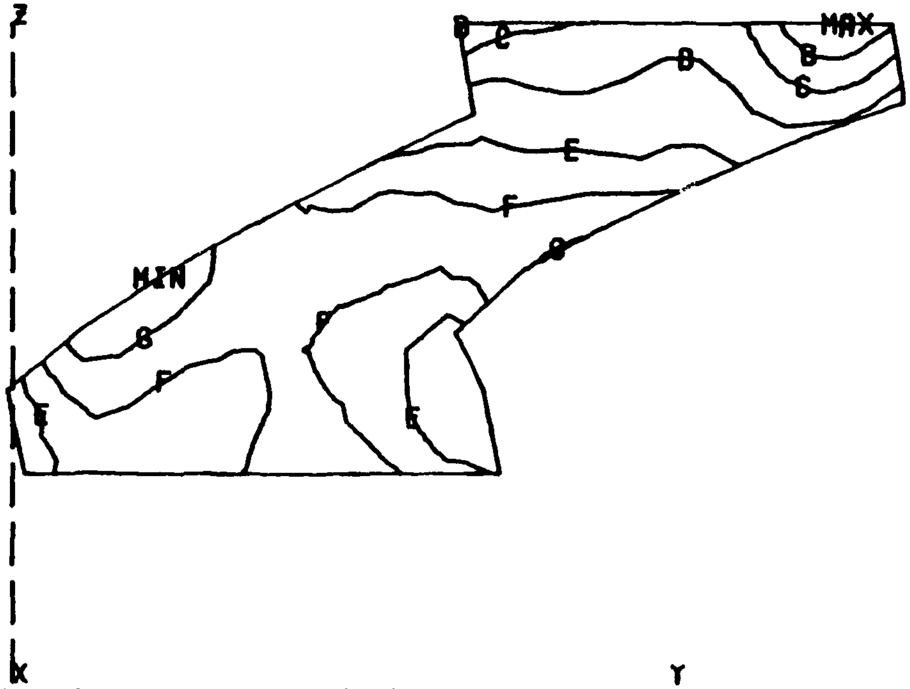
*** LEGEND ***

	F (E-06)
A	-2600.00
B	-3500.00
C	-4400.00
D	-5299.99
E	-6199.99
F	-7099.99
G	-7999.98
MAX	-2648.71
MIN	-8621.85

RUN 67 MACH 1.1 RE .5E06 ANNULAR HUB

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 18:23:08 80/015



*** LEGEND ***	F
A	256.00
B	246.00
C	236.00
D	226.00
E	216.00
F	206.00
G	196.00
MAX	256.73
MIN	189.42

RUN 67 MACH 1.1 RE .5E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 18:32:23 80/030

AD-A110 333 GENERAL MOTORS CORP INDIANAPOLIS IN DETROIT DIESEL A--ETC F/G 21/5
EXPERIMENTAL INVESTIGATION OF TURBINE ENDWALL HEAT TRANSFER. VO--ETC(U)
AUG 81 L D HYLTON, M S MIHELC, E R TURNER F33615-77-C-2030
UNCLASSIFIED DDA-EDR-10363-VOL-2 AFWAL-TR-81-2077-VOL-2 NL

4 of 4
AD
A110333

END
DATE
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2 82
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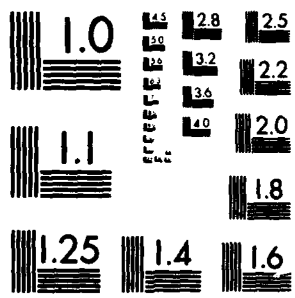
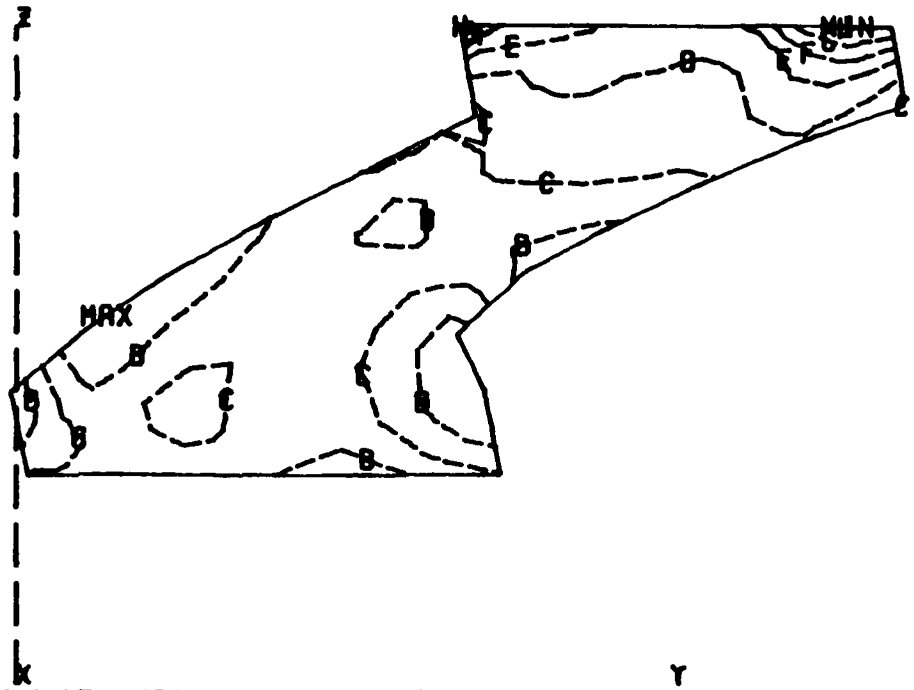


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

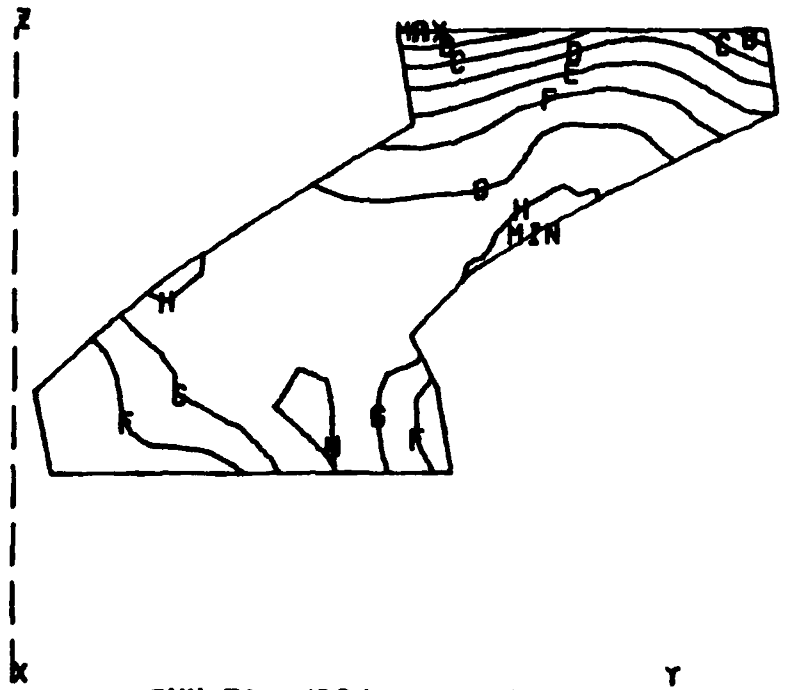


*** LEGEND ***	F (E-03)
A	-3.00
B	-5.00
C	-7.00
D	-9.00
E	-11.00
F	-13.00
G	-15.00
H	-17.00
MAX	-3.05
MIN	-17.21

RUN 67 MACH 1.1 RE .5E06 ANNULAR TIP

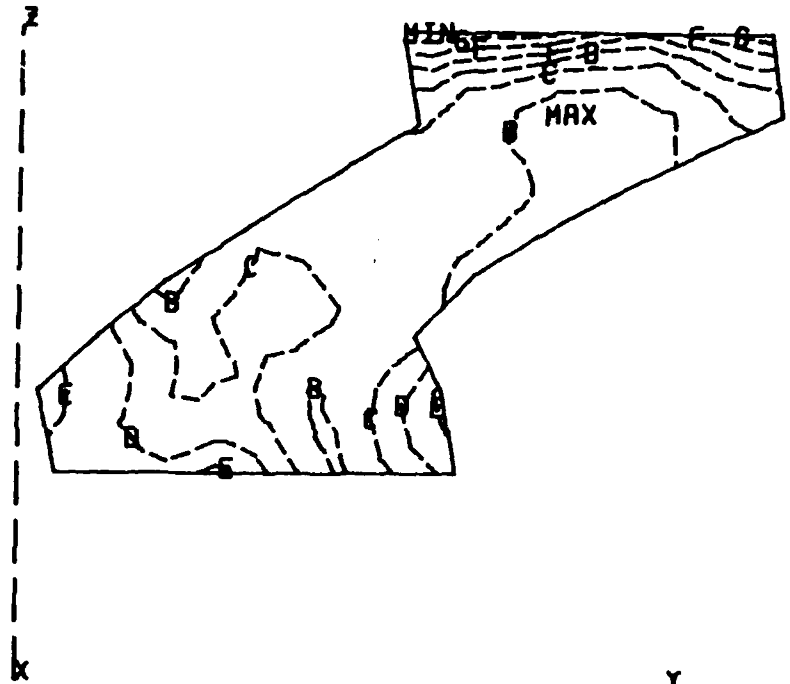
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 18:32:57 80/030



*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	1.49000E 02
B	1.46000E 02
C	1.43000E 02
D	1.40000E 02
E	1.37000E 02
F	1.34000E 02
G	1.31000E 02
H	1.28000E 02
MAX	1.49083E 02
MIN	1.26144E 02

RUN 71 MACH 1.1 RE .3E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 18:15:46 79/338



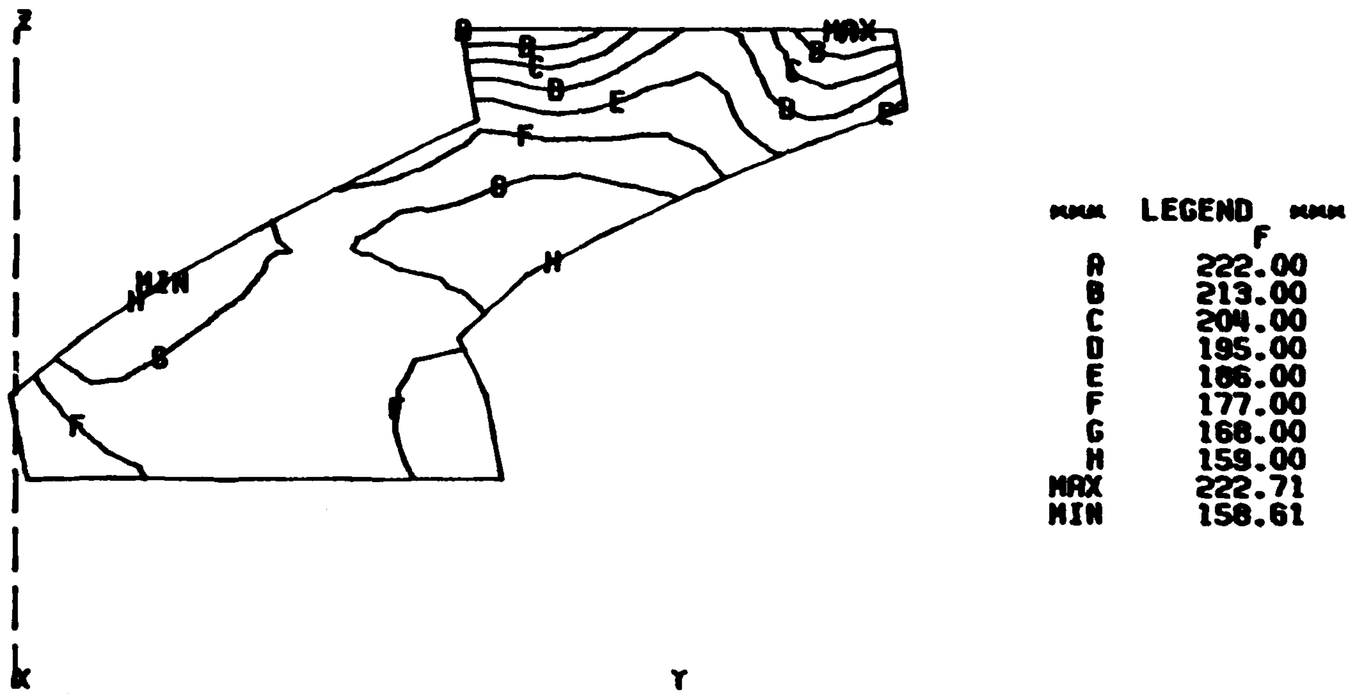
*** LEGEND ***

	F (E-06)
A	-3700.00
B	-4600.00
C	-5499.99
D	-6399.99
E	-7299.99
F	-8199.98
G	-9099.98
MAX	-3758.44
MIN	-9902.60

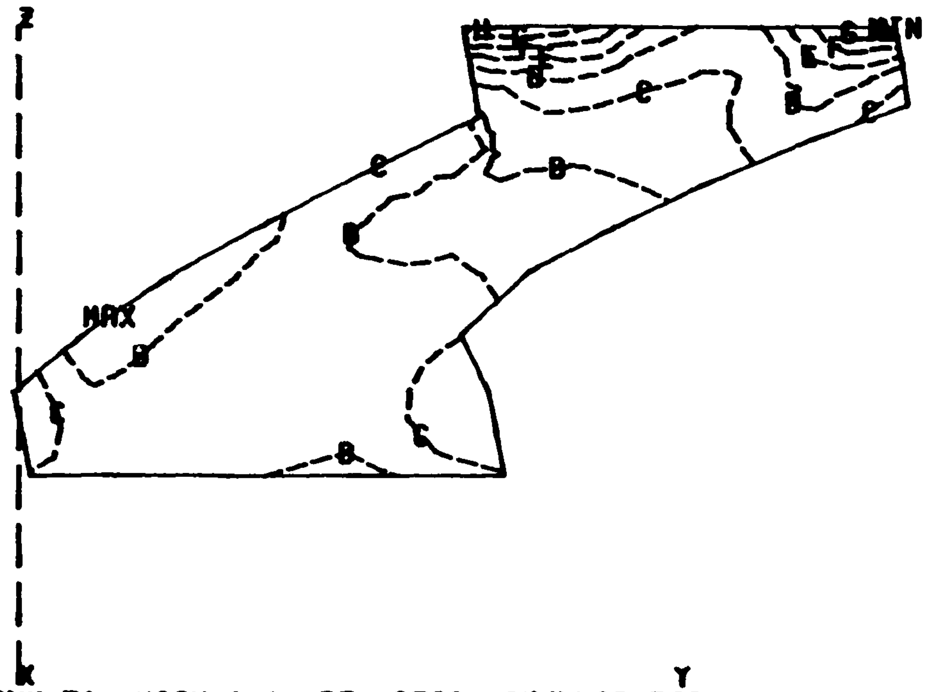
RUN 71 MACH 1.1 RE .3E06 ANNULAR HUB

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 19:06:10 80/022



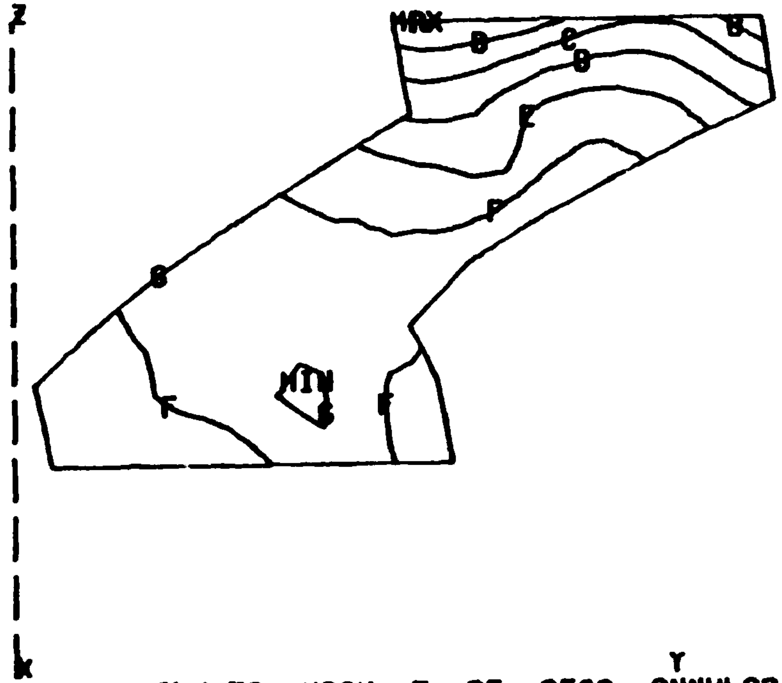
RUN 71 MACH 1.1 RE .3E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:16:50 80/031



*** LEGEND ***

	F (E-03)
A	-3.00
B	-6.00
C	-9.00
D	-12.00
E	-15.00
F	-18.00
G	-21.00
H	-24.00
MAX	-3.94
MIN	-25.32

RUN 71 MACH 1.1 RE .3E06 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 17:17:23 80/031



*** LEGEND ***

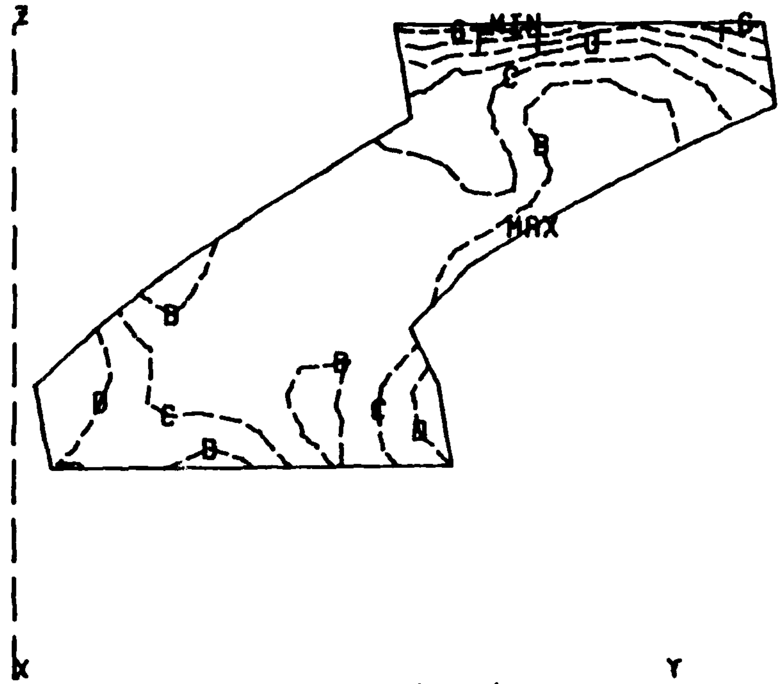
UNITS = TEMP

SYMBOL	CONTOUR
A	1.53000E 02
B	1.49000E 02
C	1.45000E 02
D	1.41000E 02
E	1.37000E 02
F	1.33000E 02
G	1.29000E 02
MAX	1.53126E 02
MIN	1.28036E 02

RUN 73 MACH .7 RE .3E06 ANNULAR HUB

CONTOUR PLOT OF TEMPERATURE

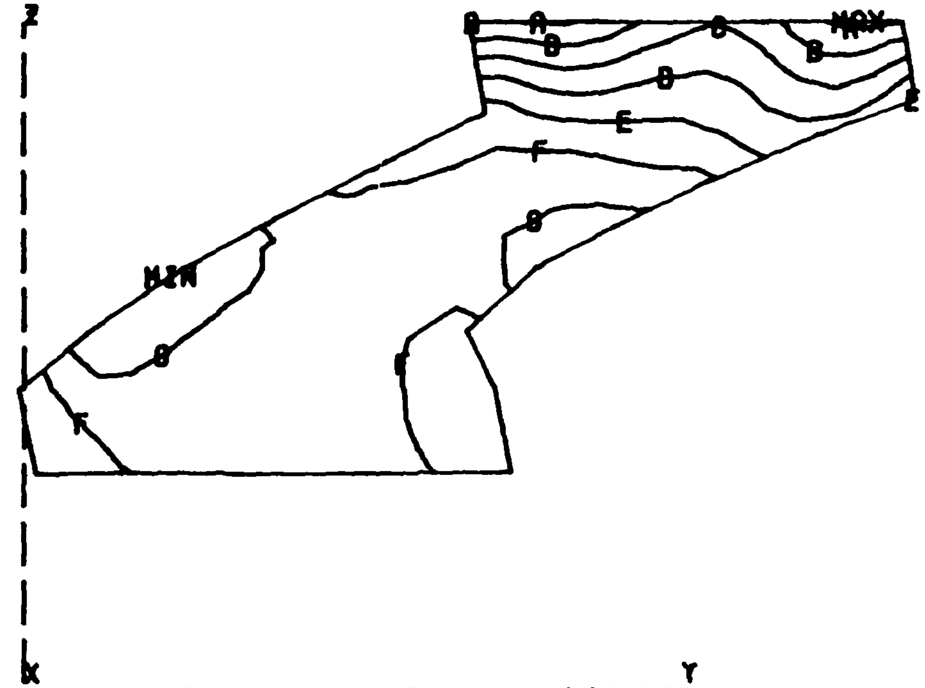
SCALE = 2.0000 PLOT TIME AND DATE = 18:41:34 79/338



*** LEGEND ***

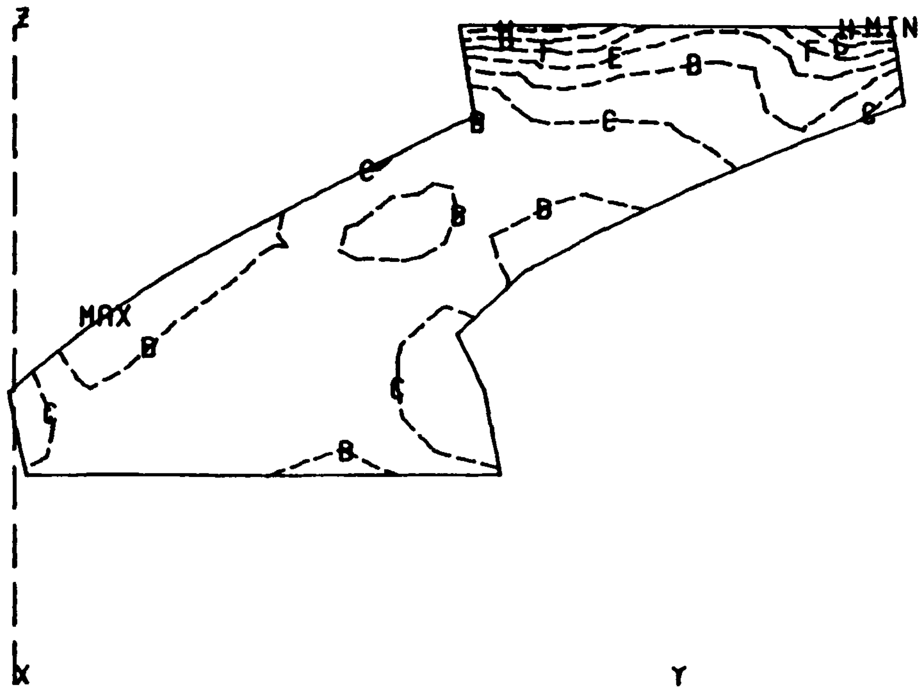
	F (E-06)
A	-3900.00
B	-4800.00
C	-5700.00
D	-6600.00
E	-7499.99
F	-8399.99
G	-9299.98
MAX	-3924.17
MIN	-9914.93

RUN 73 MACH .7 RE .3E06 ANNULAR HUB
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 19:17:59 80/022



*** LEGEND ***	F
A	230.00
B	220.00
C	210.00
D	200.00
E	190.00
F	180.00
G	170.00
MAX	232.84
MIN	162.24

RUN 73 MACH .7 RE .3E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:34:33 80/031



*** LEGEND ***	
	F
	(E-03)
A	-3.00
B	-6.00
C	-9.00
D	-12.00
E	-15.00
F	-18.00
G	-21.00
H	-24.00
MAX	-3.89
MIN	-26.76

RUN 73 MACH .7 RE .3E06 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 17:34:44 80/031

11-26-79 VANE SURVEY W/HT SURVEY

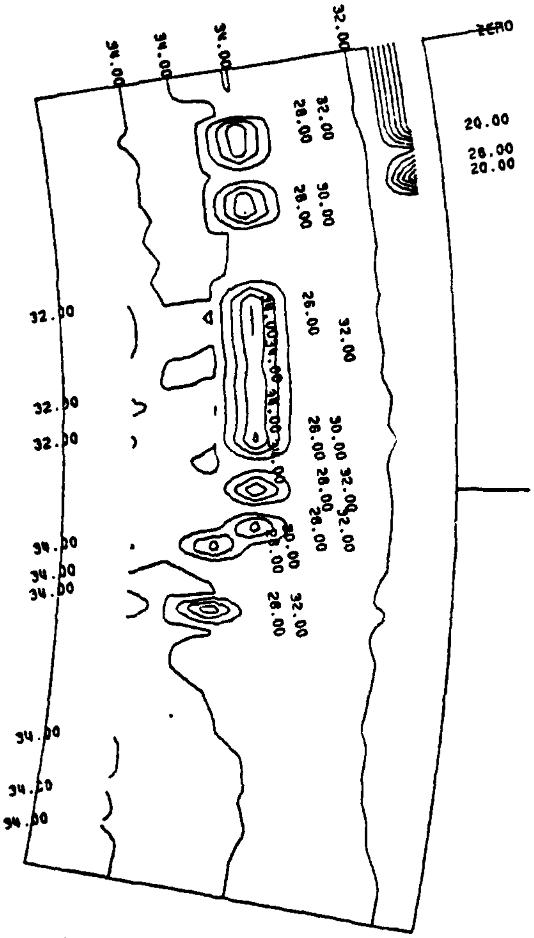
TIME 13:52 RDG 75 RIG 1 BU 51

**** COMPLETE PASSAGE DATA ****

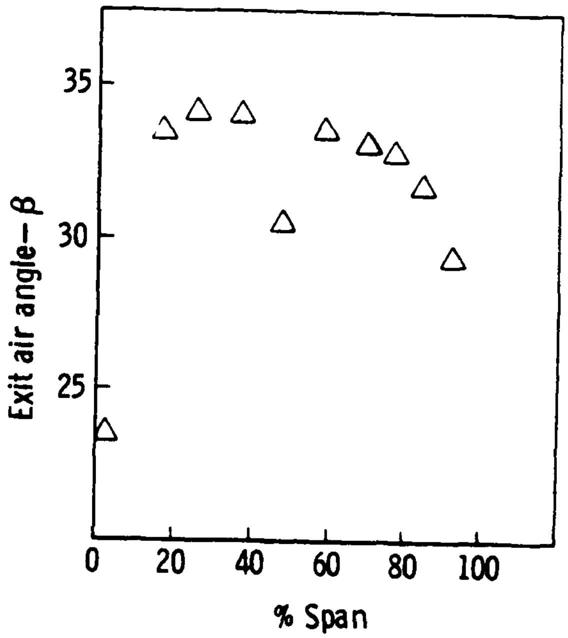
KE COEF	OMEGA ID	OMEGA ACT	DELTA P/P	FLOW RATE
0.07426	0.08474	0.10985	0.0237	2.134

RADIUS INCHES	O/O SPAN	KE COEF	OMEGA ID MASS AVG	OMEGA ACT MASS AVG	DELTA P/P MASS AVG	FLOW/L LB/SEC IN
4.5500	93.333	0.12550	0.14608	0.17259	0.03563	2.04277
4.4900	84.444	0.05437	0.06436	0.06968	0.01607	3.09635
4.4400	77.037	0.02141	0.02555	0.02705	0.00652	3.38497
4.3900	69.630	0.00930	0.01111	0.01197	0.00289	3.52583
4.3200	59.259	0.00690	0.00822	0.00906	0.00219	3.29806
4.2500	48.889	0.01450	0.01758	0.01846	0.00481	3.56831
4.1800	38.519	0.02237	0.02728	0.02862	0.00767	3.56009
4.1000	26.667	0.08228	0.09939	0.11483	0.02862	3.51841
4.0400	17.778	0.16502	0.19611	0.25870	0.05767	3.38694
3.9700	7.407	0.24180	0.28316	0.43302	0.08529	3.01699

KE COEF MIXED	OMEGA ID MIXED	OMEGA ACT MIXED	DELTA P/P MIXED	GAS ANGLE MIXED	KE MIX/KE
0.13070	0.15192	0.17913	0.03672	29.2839	1.04144
0.05464	0.06480	0.06929	0.01618	31.6764	1.00502
0.02138	0.02564	0.02631	0.00654	32.4457	0.99863
0.00936	0.01129	0.01142	0.00293	32.8170	1.00695
0.00706	0.00857	0.00864	0.00228	33.2253	1.02417
0.01874	0.02279	0.02332	0.00620	30.9414	1.29207
0.02306	0.02822	0.02904	0.00791	33.6894	1.03105
0.08300	0.10080	0.11210	0.02901	34.0638	1.00871
0.16743	0.20030	0.25046	0.05877	33.2242	1.01462
0.25663	0.29486	0.41816	0.07680	23.8915	1.06133



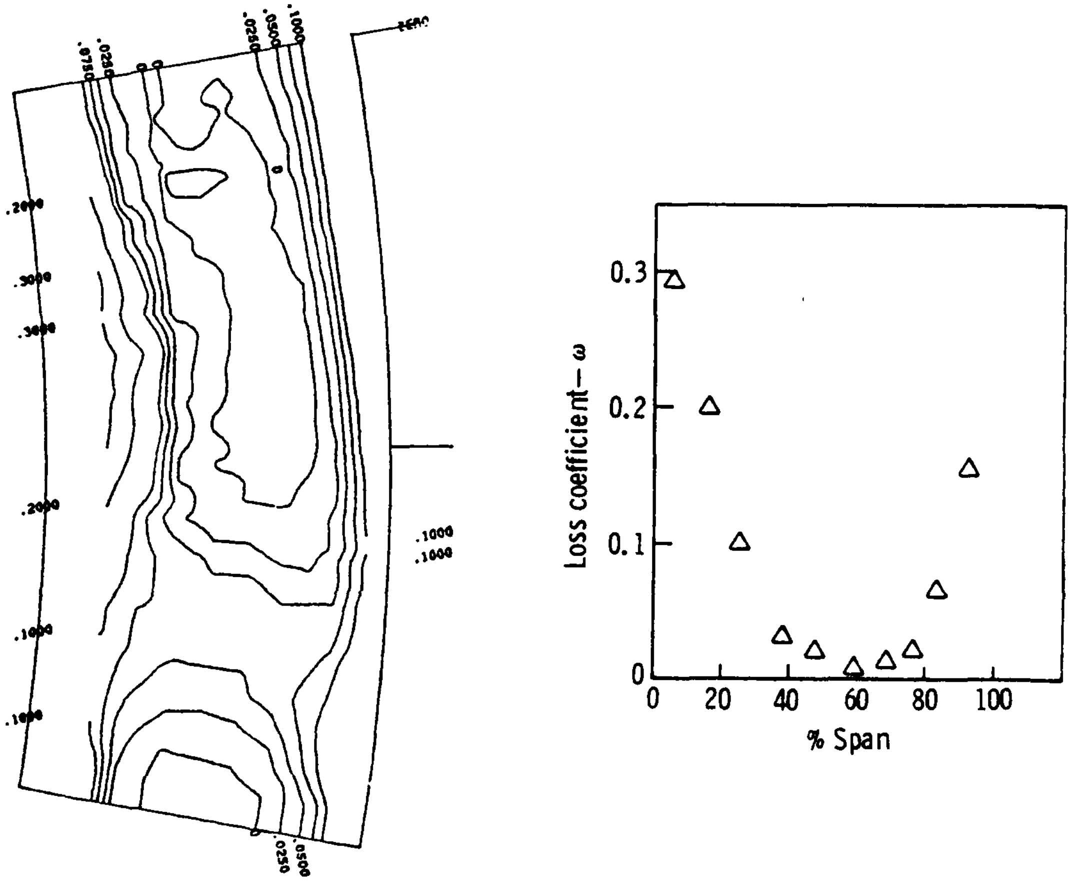
Local β contours



Exit Mach No. = 0.7 Reynolds No. =.3 x 10^6

Reading 75 - aerodynamic exit data

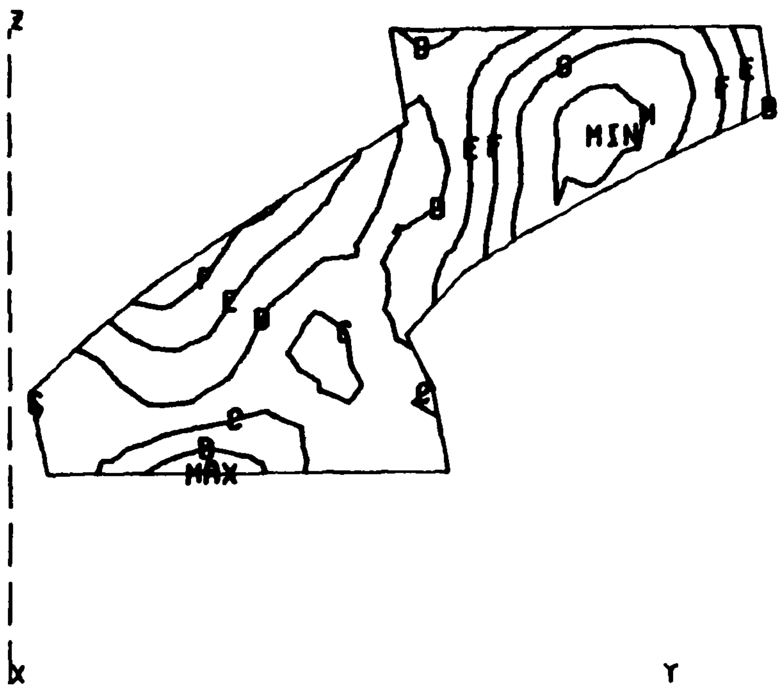
TE-80-1004



Local ω contours

Exit Mach No. = 0.7 Reynolds No. =.3 x 10^6
Reading 75 - aerodynamic exit data

TE-80-1005

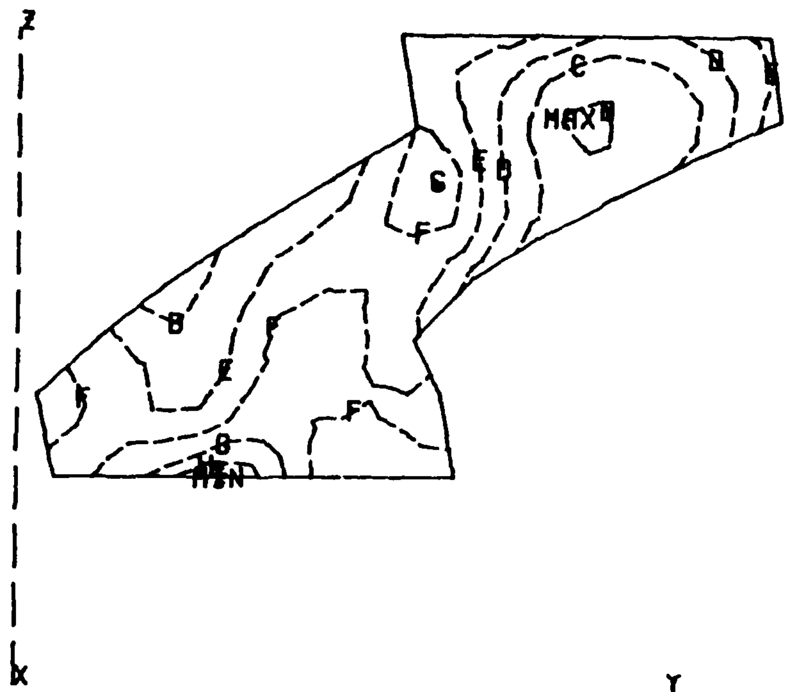


*** LEGEND ***	
UNITS = TEMP	
SYMBOL	CONTOUR
A	2.53000E 02
B	2.46000E 02
C	2.39000E 02
D	2.32000E 02
E	2.25000E 02
F	2.18000E 02
G	2.11000E 02
H	2.04000E 02
MAX	2.53738E 02
MIN	2.01452E 02

RUN 77 MACH .7 RE .7E06 ANNULAR HUB

CONTOUR PLOT OF TEMPERATURE

SCALE = 2.0000 PLOT TIME AND DATE = 18:52:49 79/338

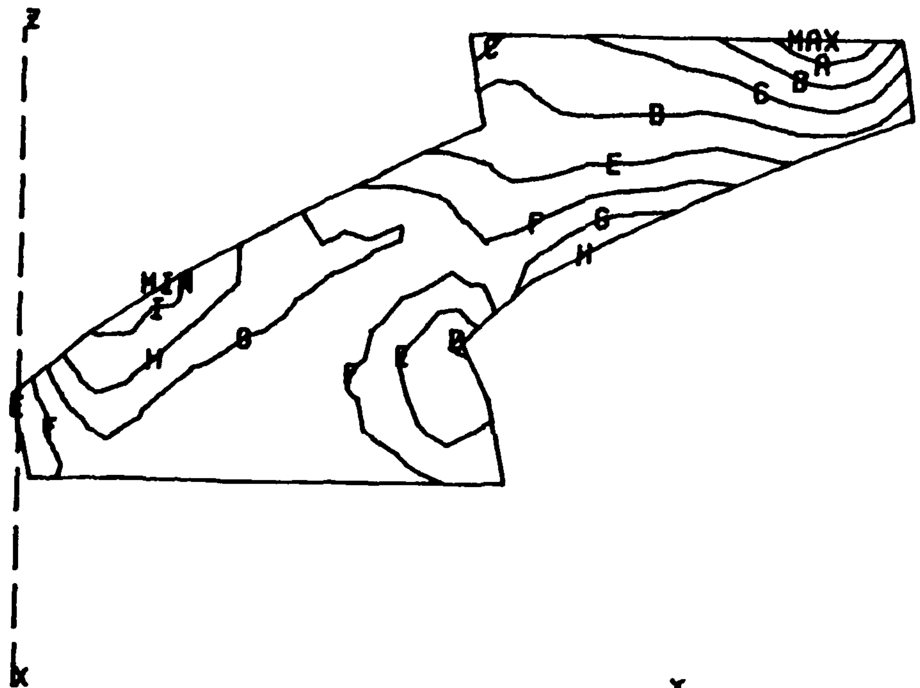


*** LEGEND ***	F (E-06)
A	-1000.00
B	-2000.00
C	-3000.00
D	-4000.00
E	-5000.00
F	-6000.00
G	-6999.99
H	-7999.99
I	-8999.99
MAX	-1849.47
MIN	-9295.31

RUN 77 MACH .7 RE .7E06 ANNULAR HUB

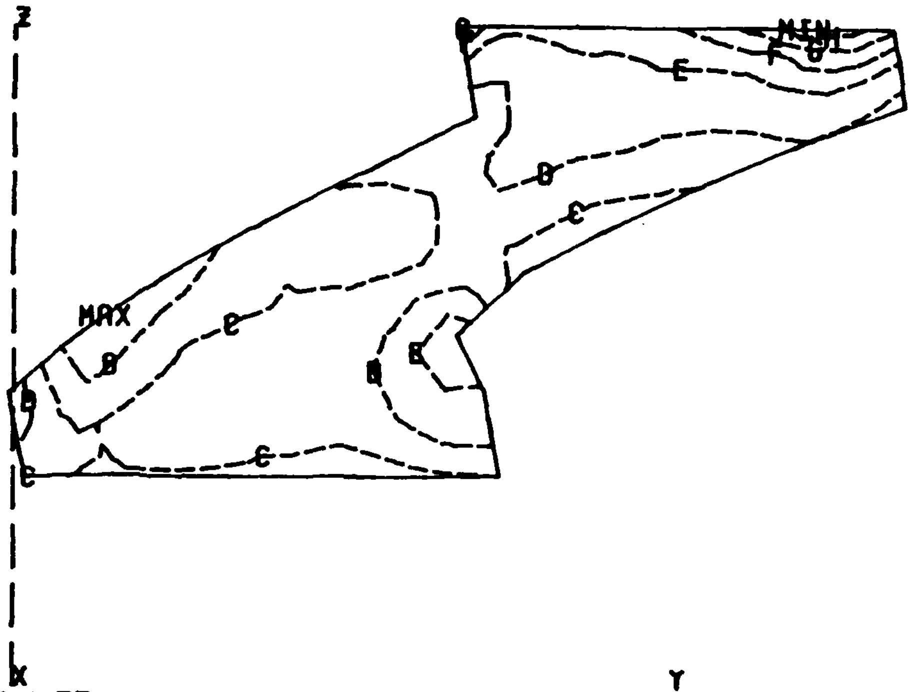
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 18:11:09 80/016



*** LEGEND ***	F
A	340.00
B	330.00
C	320.00
D	310.00
E	300.00
F	290.00
G	280.00
H	270.00
I	260.00
MAX	349.40
MIN	256.92

RUN 77 MACH .7 RE .7E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:44:01 80/031



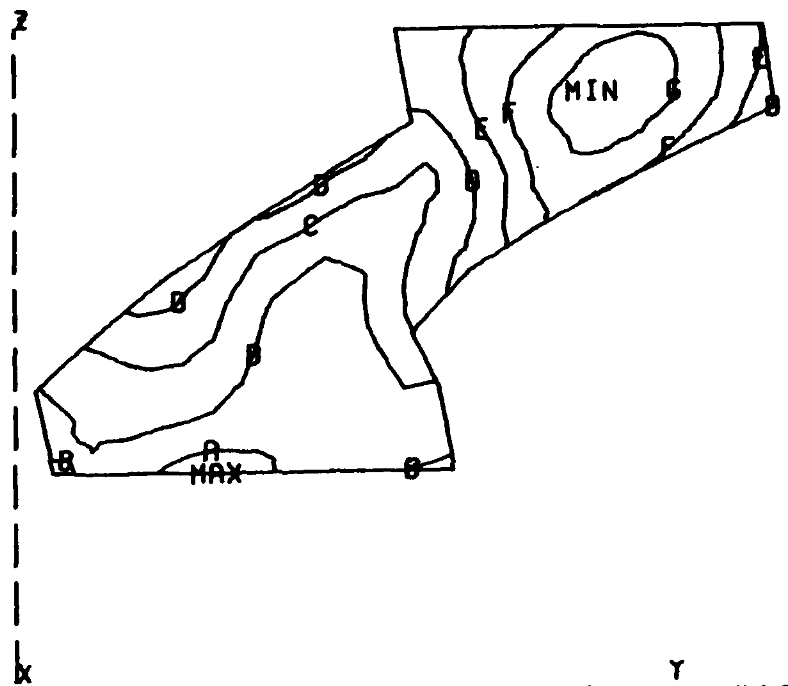
*** LEGEND ***

	F (E-03)
A	-2.00
B	-4.00
C	-6.00
D	-8.00
E	-10.00
F	-12.00
G	-14.00
H	-16.00
MAX	-2.67
MIN	-17.32

RUN 77 MACH .7 RE .7E06 ANNULAR TIP

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 17:44:23 80/031



*** LEGEND ***

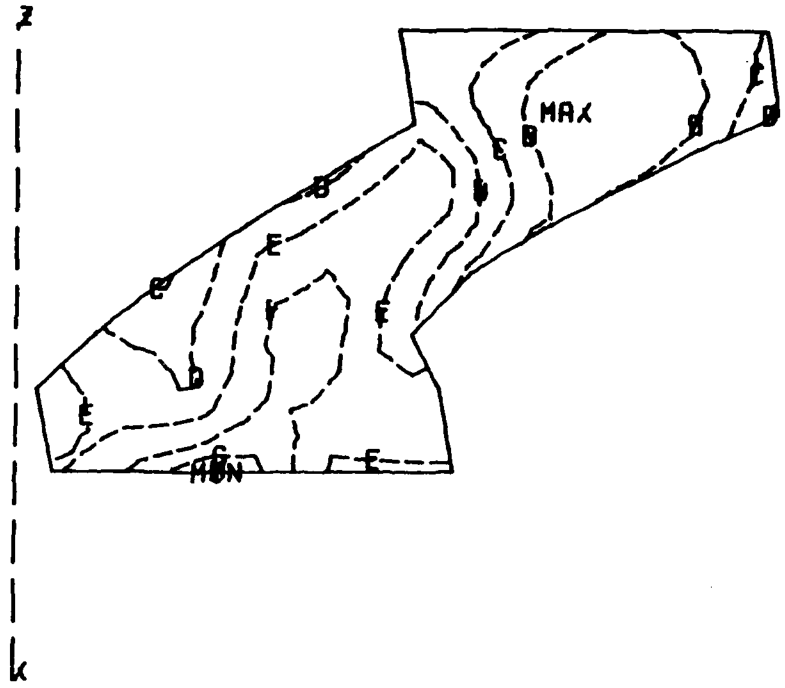
UNITS = TEMP

SYMBOL	CONTOUR
A	2.60000E 02
B	2.50000E 02
C	2.40000E 02
D	2.30000E 02
E	2.20000E 02
F	2.10000E 02
G	2.00000E 02
MAX	2.66565E 02
MIN	1.95523E 02

RUN 84 MACH 1.1 RE 1.5E06 ANNULAR HUB

CONTOUR PLOT OF TEMPERATURE

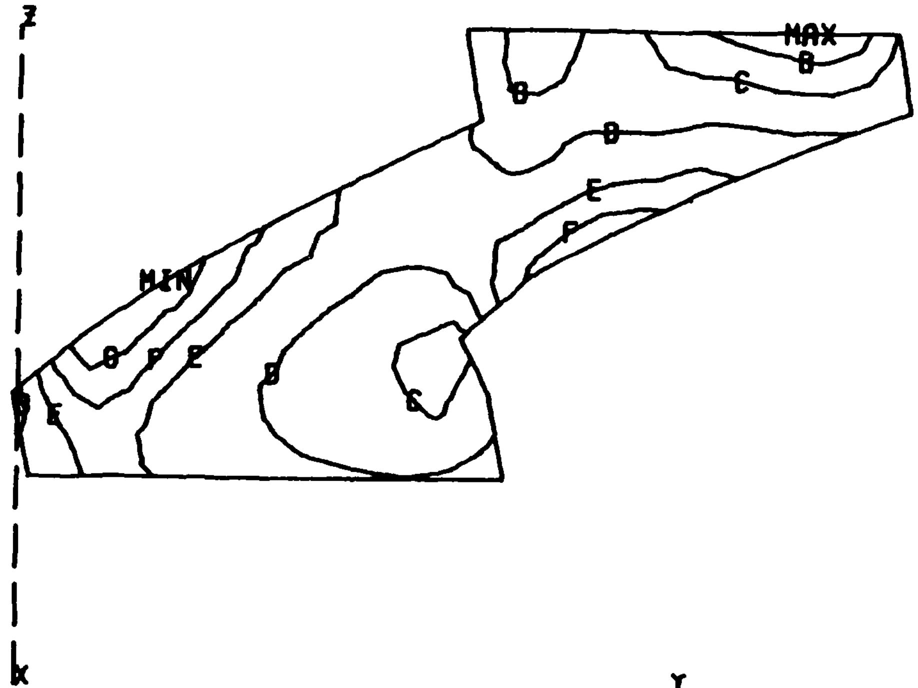
SCALE = 2.0000 PLOT TIME AND DATE = 19:25:08 79/338



*** LEGEND ***

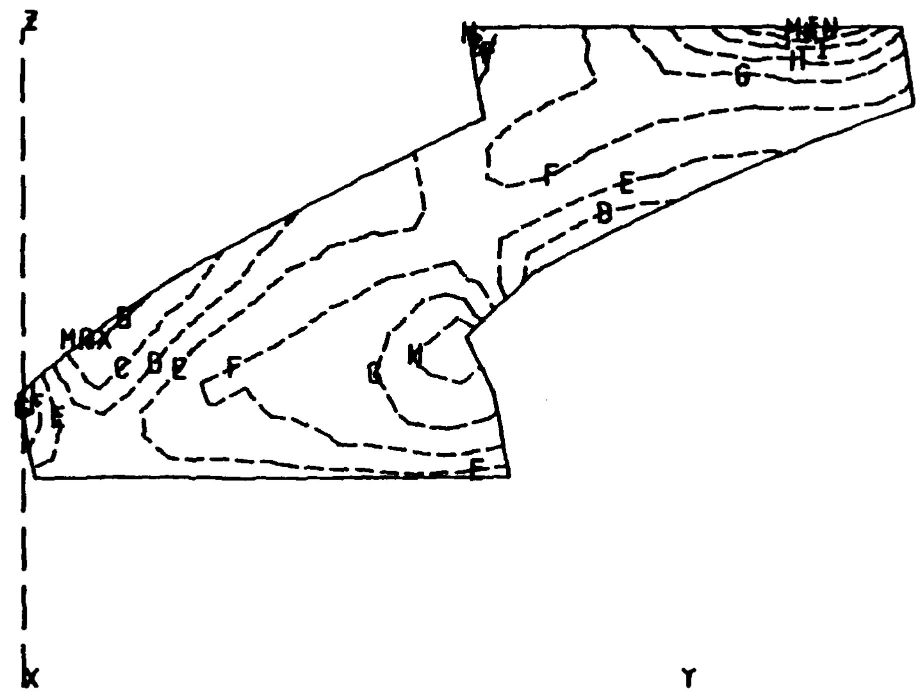
	F (E-06)
A	-1000.00
B	-2000.00
C	-3000.00
D	-4000.00
E	-5000.00
F	-6000.00
G	-6999.99
H	-7999.99
MAX	-1043.13
MIN	-8182.26

RUN 84 MACH 1.1 RE 1.5E06 ANNULAR HUB
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 17:24:39 80/017



***	LEGEND	***
	F	
A	318.00	
B	308.00	
C	298.00	
D	288.00	
E	278.00	
F	268.00	
G	258.00	
MAX	318.35	
MIN	250.58	

RUN 84 MACH 1.1 RE 1.5E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 13:54:17 80/032



*** LEGEND ***

F

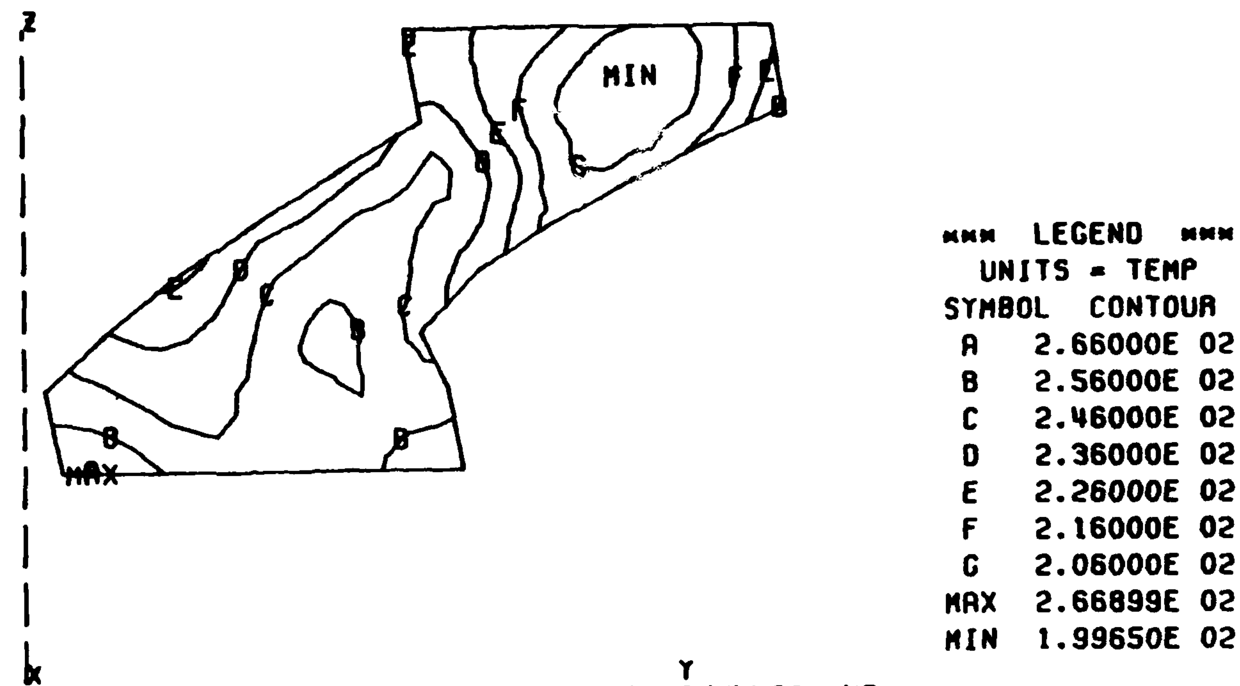
(E-06)

A	-1000.00
B	-2000.00
C	-3000.00
D	-4000.00
E	-5000.00
F	-6000.00
G	-6999.99
H	-7999.99
I	-8999.99
J	-9999.99
K	********
MAX	-1832.45
MIN	********

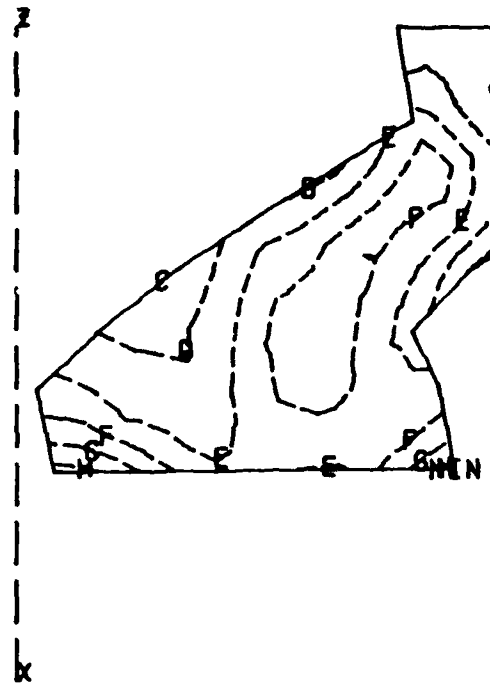
RUN 84 MACH 1.1 RE 1.5E06 ANNULAR TIP

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 13:54:39 80/032



RUN 88 MACH .7 RE 1.5E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 19:38:27 79/338



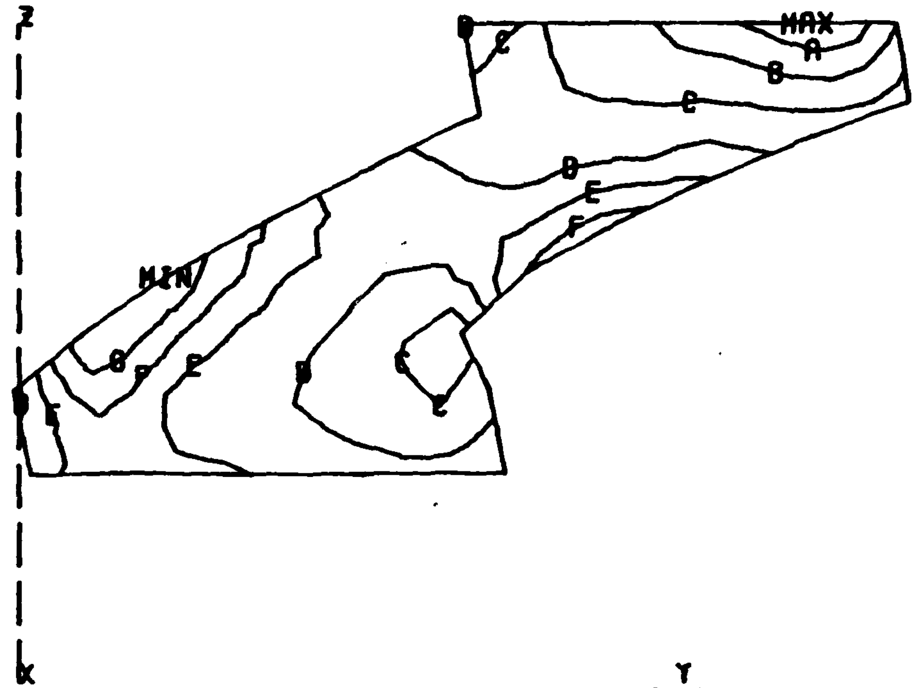
*** LEGEND ***

	F (E-06)
A	-1000.00
B	-2000.00
C	-3000.00
D	-4000.00
E	-5000.00
F	-6000.00
G	-6999.99
H	-7999.99
MAX	-1287.71
MIN	-8413.76

RUN 88 MACH .7 RE 1.5E06 ANNULAR HUB

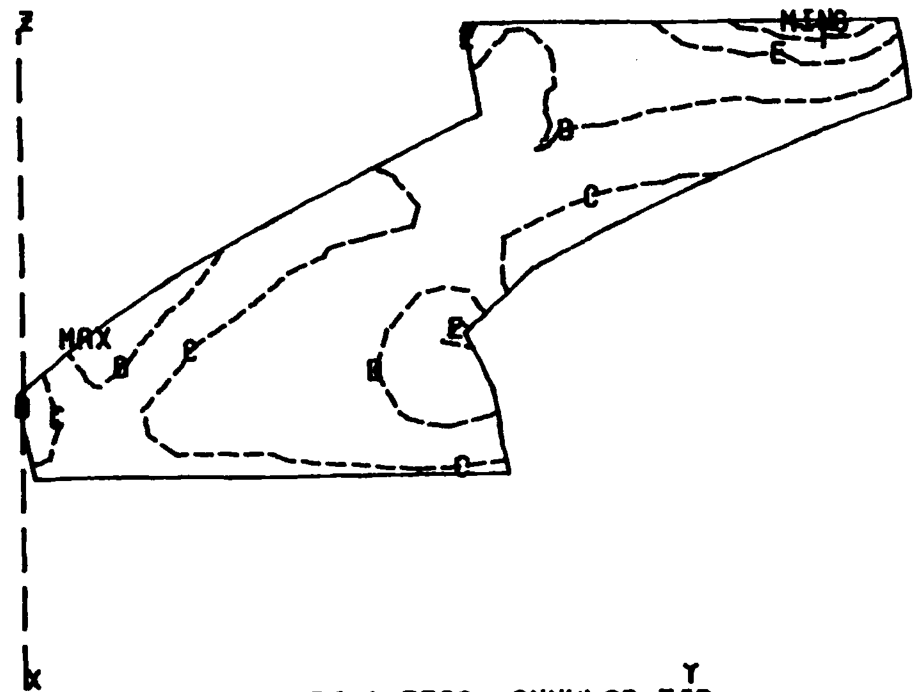
CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 19:28:19 80/022



*** LEGEND ***	F
A	320.00
B	310.00
C	300.00
D	290.00
E	280.00
F	270.00
G	260.00
MAX	329.43
MIN	252.22

RUN 88 MACH .7 RE 1.5E06 ANNULAR TIP
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 17:11:52 80/032



RUN 88 MACH .7 RE 1.5E06 ANNULAR TIP
CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 17:12:17 80/032

*** LEGEND ***

	F (E-03)
A	-1.00
B	-3.00
C	-5.00
D	-7.00
E	-9.00
F	-11.00
G	-13.00
MAX	-1.87
MIN	-14.01

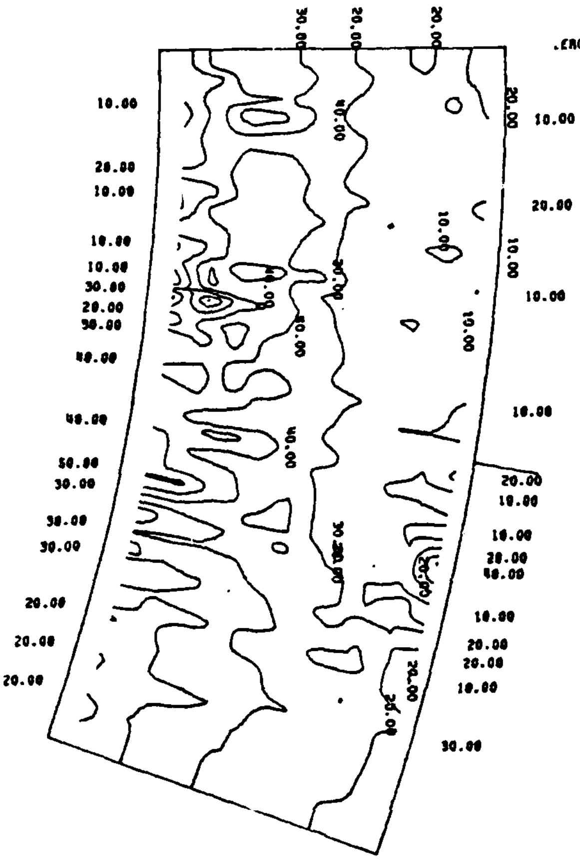
12-3-79 VANE SURVEY W/HT SURVEY

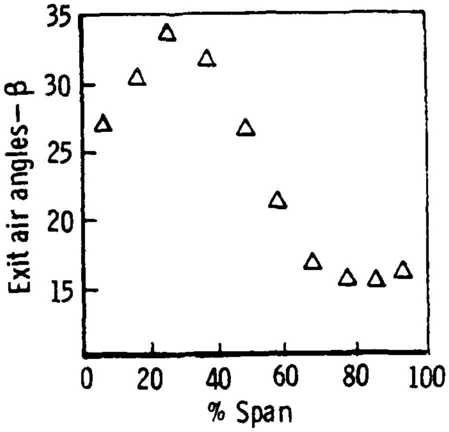
TIME 8:53 RDG 89 RIC 1 RU 51

**** KF COEF	OMEGA ID	COMPLETE PASSAGE DATA OMEGA ACT	DELTA P/P	**** FLOW RATE
0.03261	0.09473	0.12694	0.0267	[illegible]

RADIUS INCHES	O/O SPAN	KF COEF	OMEGA ID MASS AVG	OMEGA ACT MASS AVG	DELTA P/P MASS AVG	FLOW/L LB/SEC IN
4.5600	94.815	0.09303	0.11326	0.13390	0.02301	11.93725
4.5000	85.926	0.05558	0.06536	0.07485	0.01643	15.12093
4.4400	77.037	0.04131	0.04881	0.05553	0.01254	17.99533
4.3800	68.148	0.03284	0.03911	0.04360	0.01026	17.74382
4.3100	57.778	0.03459	0.04157	0.04503	0.01115	15.25458
4.2500	48.889	0.03044	0.03702	0.03950	0.01033	12.40859
4.1800	38.519	0.02463	0.02993	0.03219	0.00846	9.99117
4.1000	25.667	0.05256	0.06359	0.07219	0.01829	9.25271
4.0400	17.778	0.14567	0.17424	0.22026	0.05128	5.93319
3.9700	7.407	0.24305	0.28361	0.44775	0.08538	3.31192

KF COEF MIXED	OMEGA ID MIXED	OMEGA ACT MIXED	DELTA P/P MIXED	GAS ANGLE MIXED	[illegible]
0.15495	0.13634	0.22977	0.03956	15.9763	1.77[illegible]2
0.06715	0.07939	0.09423	0.01975	15.0592	1.26[illegible]1[illegible]
0.05297	0.06304	0.06729	0.01[illegible]	1[illegible].48[illegible]	1.22221
0.04360	0.05224	0.05512	0.01355	16.7895	1.327[illegible]
0.04124	0.04970	0.05236	0.01227	21.1812	1.194[illegible]9
0.03529	0.04273	0.04464	0.01156	26.6742	1.1[illegible]723
0.03[illegible]38	0.03705	0.03647	0.01[illegible]	31.5954	1.2[illegible]37
0.07014	0.08498	0.09287	0.02399	33.0744	1.33[illegible]
0.17175	0.20405	0.25636	0.05814	3[illegible].2[illegible]	1.17[illegible]2
0.32065	0.36[illegible]	0.58302	0.104[illegible]	2[illegible].94[illegible]	1.31[illegible]



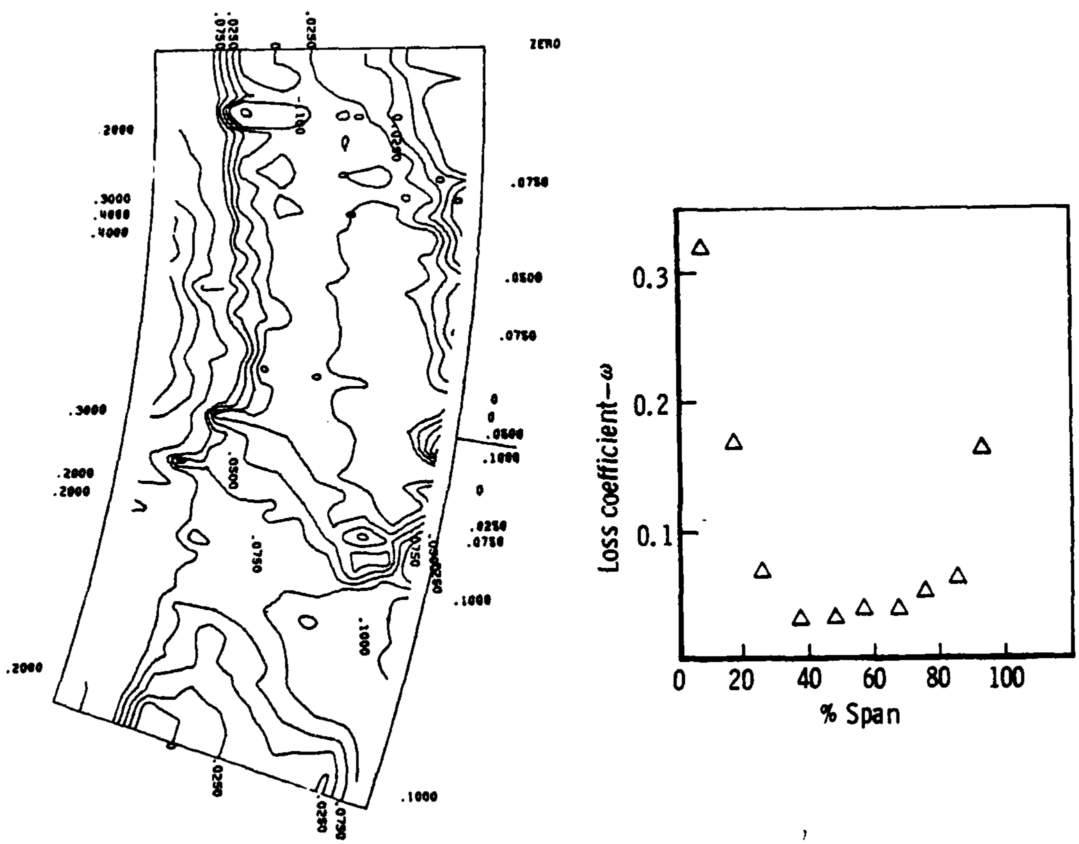


Local β contours

Exit Mach No. = 0.7 Reynolds No. = 1.46×10^6

Reading 89 - aerodynamic exit data

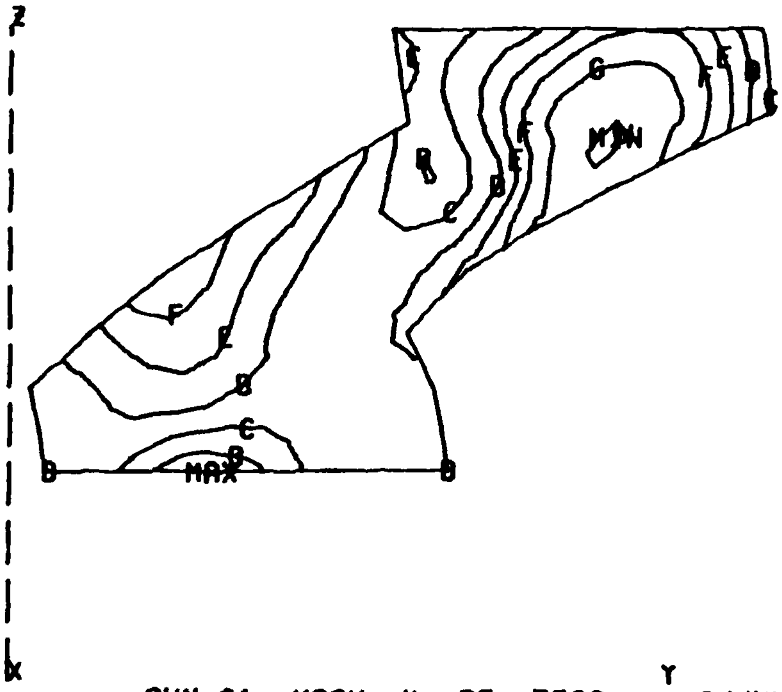
TE-80-1006



Local ω contours

Exit Mach No. = 0.7 Reynolds No. = 1.46×10^6

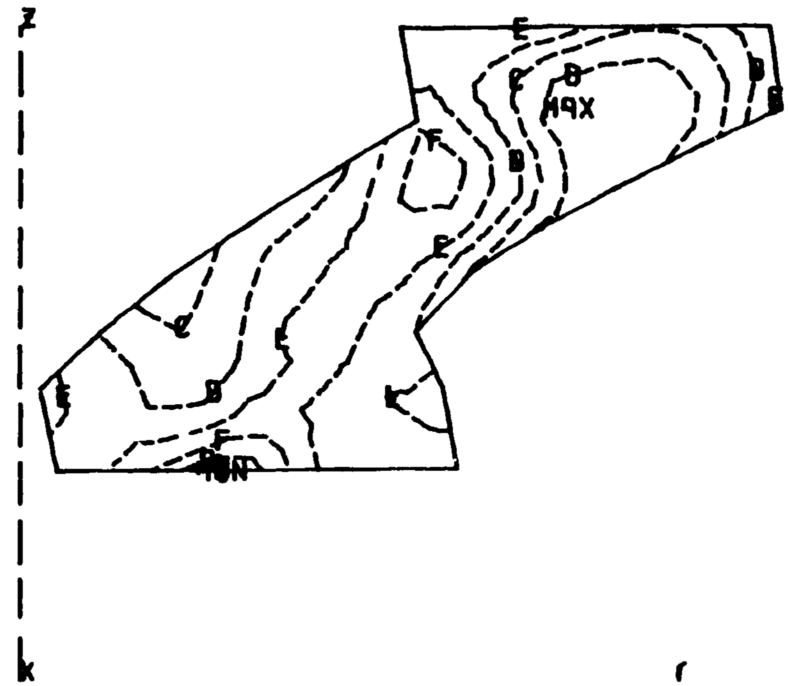
Reading 89 - aerodynamic exit data TE-80-1007



*** LEGEND ***
UNITS = TEMP

SYMBOL	CONTOUR
A	2.08000E 02
B	2.03000E 02
C	1.98000E 02
D	1.93000E 02
E	1.88000E 02
F	1.83000E 02
G	1.78000E 02
H	1.73000E 02
MAX	2.08248E 02
MIN	1.72516E 02

RUN 91 MACH .4 RE .7E06 ANNULAR HUB
CONTOUR PLOT OF TEMPERATURE
SCALE = 2.0000 PLOT TIME AND DATE = 19:50:24 79/338

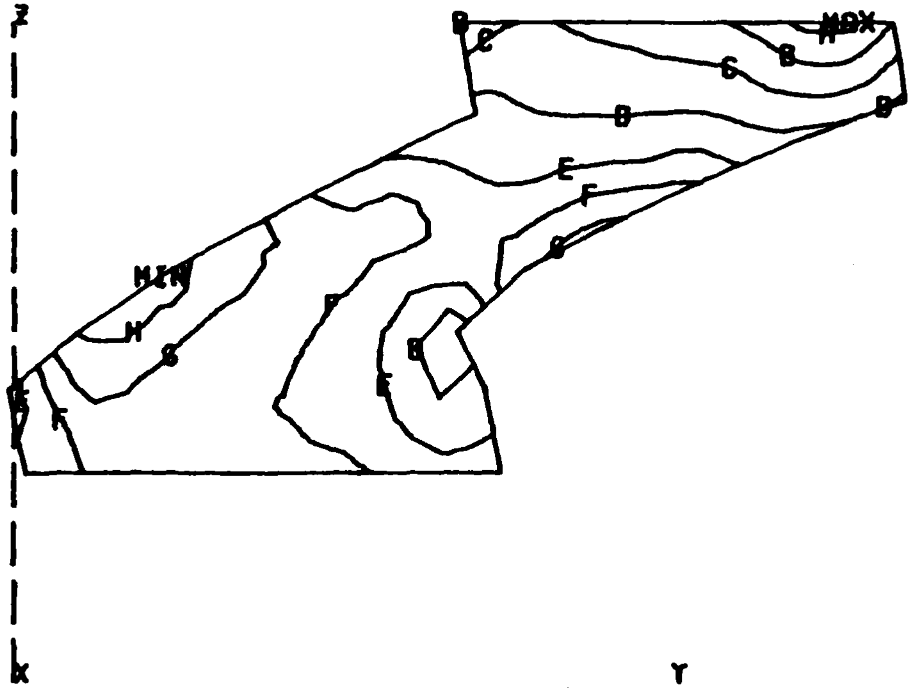


***	LEGEND ***	
	F	
	(E-06)	
A	-2000.00	
B	-2900.00	
C	-3800.00	
D	-4700.00	
E	-5600.00	
F	-6499.99	
G	-7399.99	
H	-8299.99	
MAX	-2059.85	
MIN	-8450.50	

RUN 91 MACH .4 RE .7E06 ANNULAR HUB

CONTOUR PLOT OF STANTON NUMBER.

SCALE = 2.0000 PLOT TIME AND DATE = 17:42:28 60/017



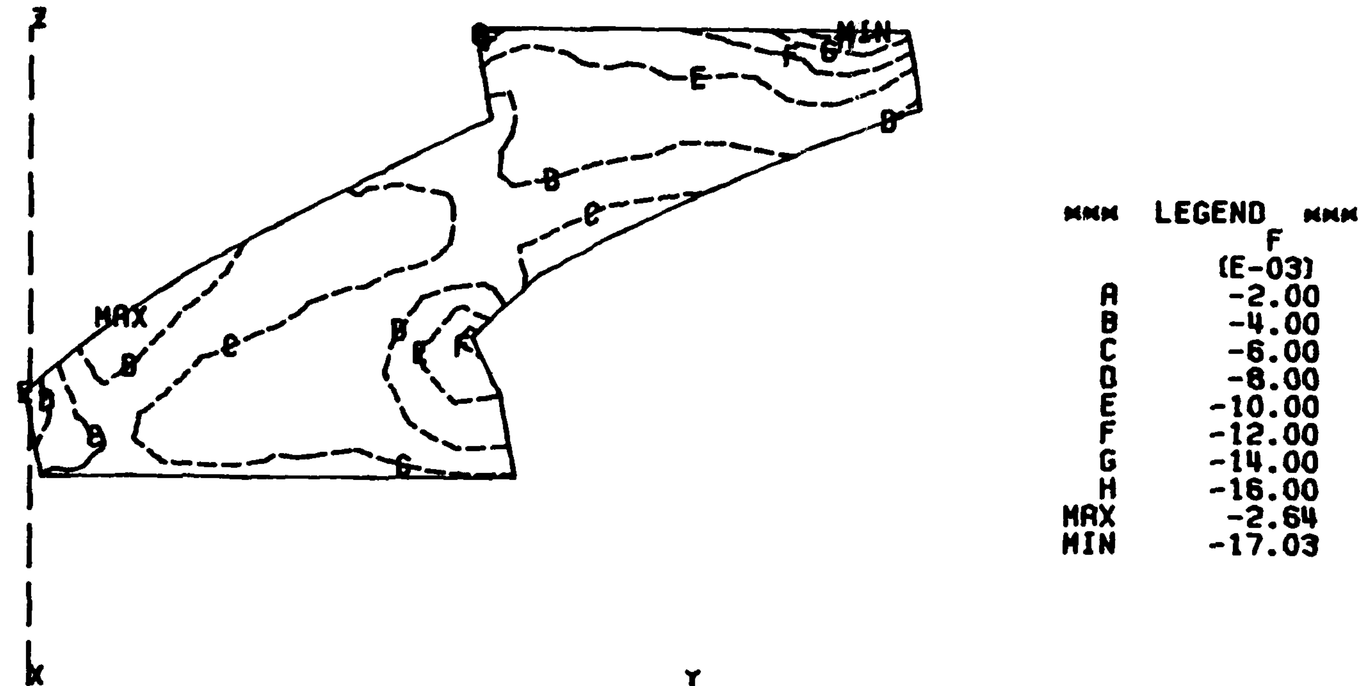
*** LEGEND ***

	F
A	290.00
B	280.00
C	270.00
D	260.00
E	250.00
F	240.00
G	230.00
H	220.00
MAX	292.90
MIN	215.91

RUN 91 MACH .4 RE .7E06 ANNULAR TIP

CONTOUR PLOT OF TEMPERATURE

SCALE = 2.0000 PLOT TIME AND DATE = 17:22:14 80/032



RUN 91 MACH .4 RE .7E06 ANNULAR TIP

CONTOUR PLOT OF STANTON NUMBER.
SCALE = 2.0000 PLOT TIME AND DATE = 17:22:29 80/032

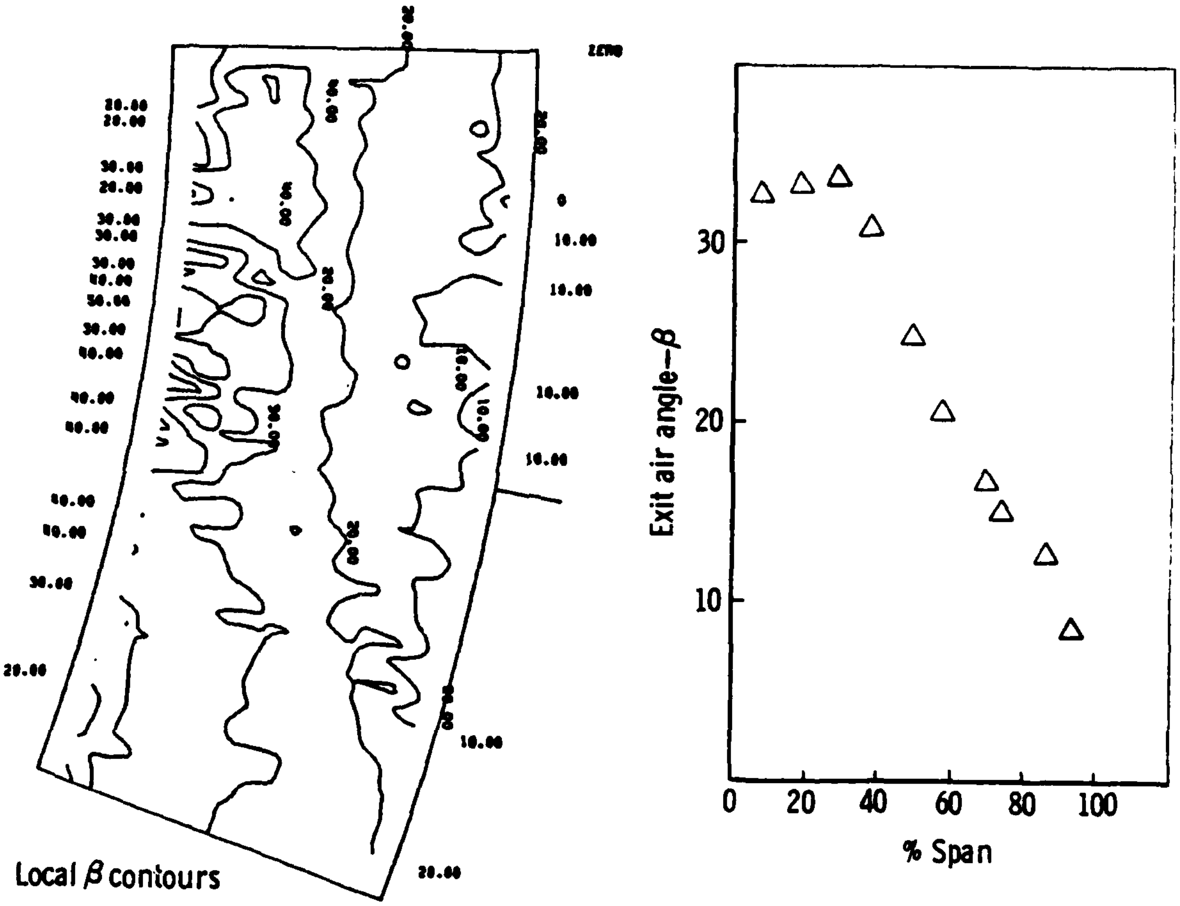
12-5-79 VANE SURVEY W/HT SURVEY

TIME [illegible] RDG 92 RIT 1 RU 51

**** KE COEF	OMEGA ID	COMPLETE PASSAGE DATA OMEGA ACT	DELTA P/P	**** FLOW RATE
0.07645	0.07790	0.09923	0.0086	4.461

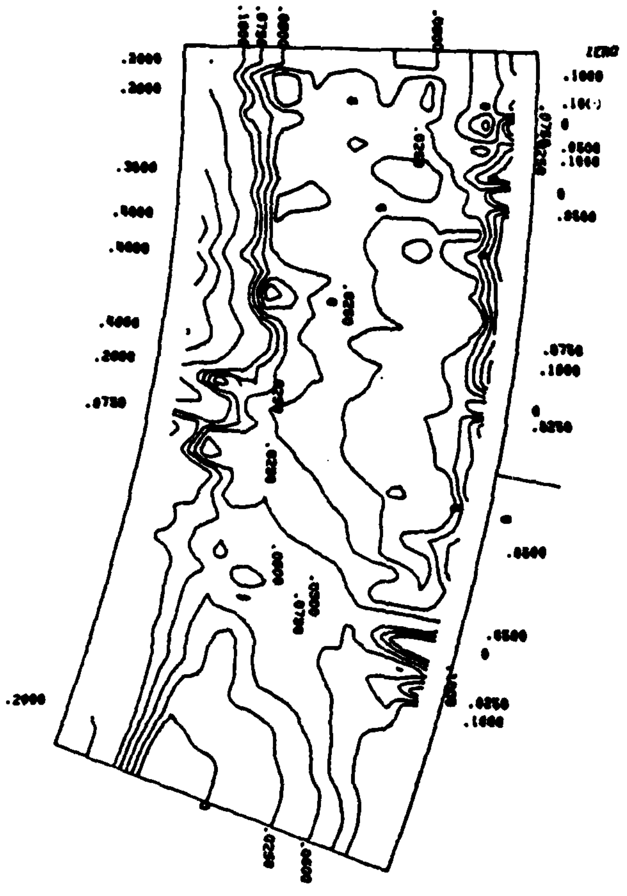
RADIUS INCHES	% SPAN	KE COEF	OMEGA ID MASS AVG	OMEGA ACT MASS AVG	DELTA P/P MASS AVG	FLOW/L LB/SEC IN
4.5000	93.333	0.09146	0.09657	0.10871	0.00854	7.91735
[illegible]	85.926	0.04593	0.04861	0.05412	0.00460	9.12515
4.4200	74.074	0.02672	0.02843	0.03145	0.00276	9.70094
4.3900	69.630	0.02295	0.02434	0.02659	0.00246	9.08133
4.3[illegible]	57.778	0.02436	0.02601	0.02747	0.00263	7.44537
4.2700	48.889	0.02852	0.03053	0.03198	0.00315	6.26192
4.1700	37.037	0.02420	0.02589	0.02750	0.00274	5.09163
4.1100	28.148	0.03119	0.03339	0.03599	0.00363	4.78596
4.0[illegible]	17.778	0.10515	0.11323	0.13348	0.01266	3.90080
[illegible]	7.407	0.21369	0.22597	0.32016	0.02594	2.52263

KE COEF MIXED	OMEGA ID MIXED	OMEGA ACT MIXED	DELTA P/P MIXED	GAS ANGLE MIXED	KE MIX/KE
0.09481	0.10011	0.11125	0.00906	8.3416	1.03656
0.05877	0.06231	0.06646	0.00582	12.0527	1.27946
0.03998	0.04252	0.04441	0.00439	15.5107	1.49654
0.03254	0.03464	0.03588	0.00335	16.5321	1.41750
0.03355	0.03579	0.03712	0.00358	20.5929	1.37697
0.03221	0.03444	0.03566	0.00354	24.7610	1.12925
0.02954	0.03163	0.03267	0.00333	31.0068	1.22066
0.04147	0.04442	0.04648	0.00475	33.9327	1.32957
0.12536	0.13368	0.15430	0.01403	33.0076	1.18094
0.27091	0.28544	0.39946	0.03035	32.7591	1.26777

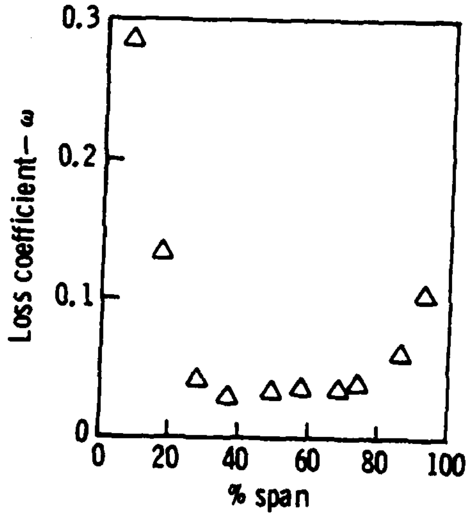


Exit Mach No. = 0.4 Reynolds No. 0.7×10^6
Reading 92 - aerodynamic exit data

TE-80-1008



Local ω contours



Exit Mach No. = 0.4 Reynolds No. = 0.7×10^6

Reading 92 - aerodynamic exit data

TE-80-1009

4.0 TURBULENCE MEASUREMENTS

Inlet turbulence intensity measurements were made in the linear cascade. The measurements were made with the DDA laser doppler anemometer (LDA), which is described in detail in Section 3.2.7 of Volume I. For this application the system was aligned in 15° off-axis backscatter, with a fringe spacing of 7.72 μm and a laser power of 350 mw.

As explained in Section 3.2.7 of Volume I, optical access to the cascade was provided by installing quartz windows in the endwall that had previously been used for making the adiabatic endwall temperature measurements. This optical access allowed turbulence intensity measurements to be made midway between vanes 3 and 4 at a point 0.16 inch downstream of the vane leading edge plane. Traverses were made across the span and data was taken at 1/2-inch intervals over a range from 1 inch on each side of the centerline. Measurements could not be taken closer than 1/2 inch to the endwall due to reflections.

Measurements were made at inlet gas temperatures of 600°F, 800°F, and 1000°F with the facility burner operating. At these three temperature levels measurements were made at an exit Mach number of 0.7 and at Reynolds numbers matching those of the baseline heat transfer tests. An additional set of data was taken at an exit Mach number of 0.3 and a gas temperature of 800°F. This condition provided inlet flow parameters different from the 0.7 exit Mach number cases.

Span-averaged values of the turbulence intensity did not indicate the variation with gas temperature that was expected. Table 5 lists these values with the associated run conditions.

TABLE 5. SPANWISE-AVERAGED TURBULENCE INTENSITY

Gas Temperature (°F)	Exit Mach Number	Exit Reynolds Number	Turbulence Intensity (%)
600	0.7	0.75×10^6	9.35 ± 0.47
800	0.7	0.60×10^6	7.95 ± 0.40
1000	0.7	0.54×10^6	7.90 ± 0.40
800	0.3	0.20×10^6	8.43 ± 0.42

The uncertainity limits on the turbulence intensity reflect only the statistical uncertainity inherent in making the calculation from 1000 particle velocities.

The spanwise profiles were as expected, with minimum values of the turbulence intensity measured at midspan and the level increasing as the wall was approached. At a point 1/2 inch from the wall, levels were nominally 15% higher than the midspan values. The spanwise profiles for the four runs in Table 5 are shown in Figures 1 through 4. In the figures the 0.00 span position represents the heat transfer endwall, whereas the 3.00 span position represents the quartz window.

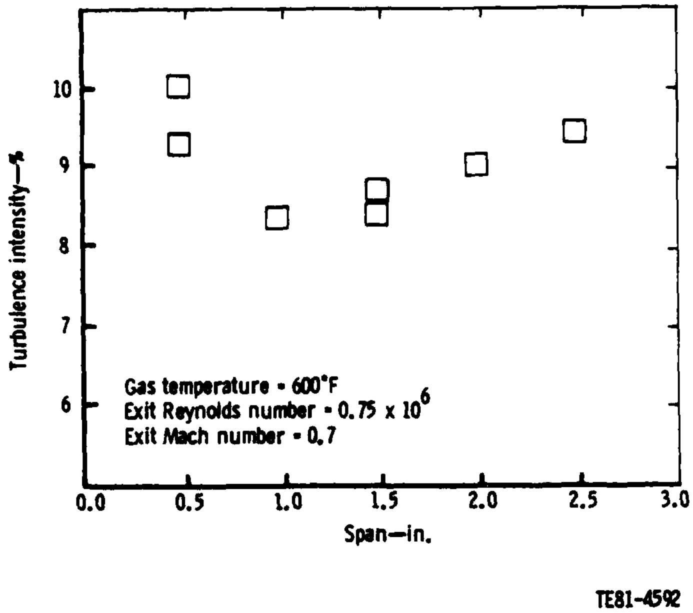


Figure 1. Spanwise turbulence intensity variation at 600°F.

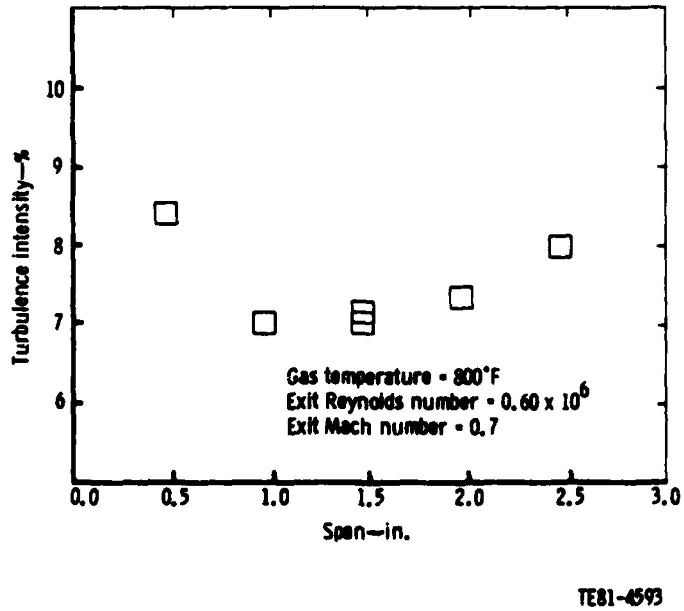


Figure 2. Spanwise turbulence intensity variation at 800°F.

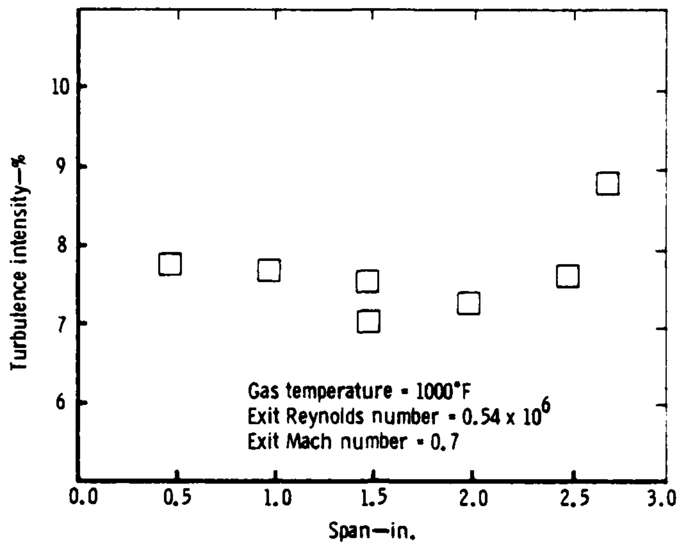


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Figure 3. Spanwise turbulence intensity variation at 1000°F.

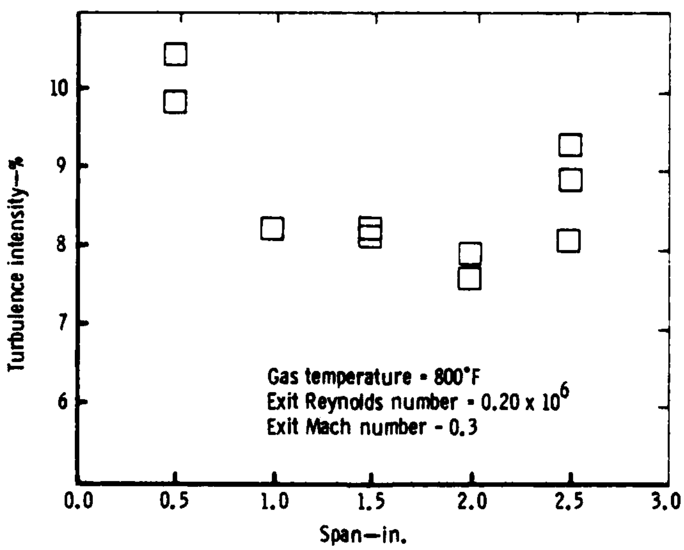

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Figure 4. Spanwise turbulence intensity variation at 800°F for reduced exit Mach number.

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